

BRITISH AND COLONIAL FLAGS



UNION JACK



RED ENSIGN



SCOTLAND



IRELAND



SOUTH AUSTRALIA



TASMANIA



AUSTRALIA



VICTORIA



TRINITY HOUSE



GOVERNOR



ROYAL STANDARD

WHITE ENSIGN



ADMIRALTY



AUSTRALIA



N.S. WALES



QUEENSLAND



INDIA



ARGENTINE



AUSTRIA



MALTA



NEW ZEALAND



CANADA



CAPE COLONY



HUNGARY



BELGIUM



ENSIGN



BOLIVIA



BRAZIL



BULGARIA



CHILI



PRESIDENT ENSIGN



IMPERIAL



COLOMBIA



FREE STATE



COSTA RICA



ROYAL STANDARD



DENMARK



MERCHANT



DOMINICAN REPUBLIC



ECUADOR



EGYPT



FRANCE



IMPERIAL



NAVAL



GERMANY



GREECE



ITALY



JAPAN



GUATEMALA



HAYTI



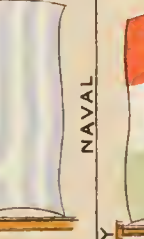
HONDURAS



ITALY



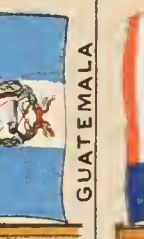
ITALY



NORWAY



NORWAY



LIBERIA



MEXICO



MONTENEGRO



NETHERLANDS



NICARAGUA



PERU



PORTUGAL



ROUMANIA



RUSSIA



SPAIN



SWITZERLAND



SALVADOR



SERBIA



SIAM



SWEDEN



SWITZERLAND



TASMANIA



TASMANIA



TRANSVAAL



TURKEY



UNITED STATES



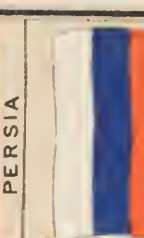
UNITED STATES



UNITED STATES



UNITED STATES



UNITED STATES



VENEZUELA



VENEZUELA



VENEZUELA



VENEZUELA



VENEZUELA



VENEZUELA



VENEZUELA

THE
STOREHOUSE
OF
GENERAL INFORMATION



MORLAKE—RUBEOLA

CASSELL AND COMPANY LIMITED

LONDON PARIS & MELBOURNE

1894

ALL RIGHTS RESERVED



AE5
.S98
1851
vol 7-8

AUTHORS OF PRINCIPAL ARTICLES.

MUSIC	W. H. HADOW, M.A.	PHYSICS AND OTHER PHYSICAL ARTICLES	L. EDNA WALTER, B.Sc.
NAPOLEON BONAPARTE ...	{ LEWIS BUTLER, <i>late Captain King's Royal Rifle Corps.</i>	PIG, PIGEON, AND OTHER ZOOLOGICAL ARTICLES ...	H. SCHERREN, F.Z.S.
NAVY	W. LAIRD CLOWES.	PIGMENTS AND OTHER CHEMICAL ARTICLES ...	L. M. JONES, B.Sc.
NEGRO, NEGRITO, AND OTHER ETHNOLOGICAL ARTICLES	{ PROF. A. H. KEANE, <i>Vice-President of the Anthropological Society.</i>	PLATO	D. J. O'DONOGHUE.
NERVE AND OTHER MEDICAL ARTICLES	{ W. H. HAMER, M.A., M.D.	POACHING AND OTHER LEGAL ARTICLES	C. ETHERINGTON.
NORWAY	A. H. MANN.	POETRY	W. W. HUTCHINGS.
NOTATION AND OTHER MATHEMATICAL ARTICLES ...	{ L. EDNA WALTER, B.Sc.	POLITICAL ECONOMY	J. S. MANN.
ORDNANCE SURVEY... ..	C. E. D. BLACK.	POST OFFICE	E. BENNETT.
OXFORD UNIVERSITY ...	{ REV. H. E. D. BLAKISTON, <i>Trinity College, Oxford.</i>	POTTERY	J. SPARKES.
PARASITISM (VEGETABLE), AND OTHER BOTANICAL ARTICLES	{ PROF. G. S. BOULGER.	PRINTING	J. SOUTHWARD.
PARIS	H. SUTHERLAND EDWARDS.	PRUSSIA	W. J. JEAFFRESON.
PAUL, St.	REV. D. C. TOVEY.	PSYCHOLOGY	A. H. MANN.
PERSIA	C. E. D. BLACK.	RAILWAYS	J. P. PATTINSON.
PHILOSOPHY	T. WHITTAKER.	REFORMATION	DR. C. A. M. FENNELI
PHOTOGRAPHY	L. M. JONES, B.Sc.	ROMAN CATHOLIC CHURCH	T. G. LAW.
		ROME	{ FINDLAY MUIRHEAD AND J. II. FREESE.
		ROTIFERA AND OTHER ZOOLOGICAL ARTICLES ...	{ DR. J. W. GREGORY, <i>British Museum.</i>

LIST OF PLATES.

FLAGS OF ALL NATIONS	... ..	... Frontis.
NAVY	... ..	To face page 65
FUNGOID DISEASES OF PLANTS	... ..	129
PIGEONS	... ..	193
PLAN OF NEW YORK	... ..	257
ROME	... ..	321

98-117535

CASSELL'S

STOREHOUSE OF GENERAL INFORMATION

Morlaks, a people of North Dalmatia, between the River Narenta and the Croatian frontier, at present of Serb (Slav) speech, but said to be originally of Hun or Ugrian (Bulgarian) descent. Morlak is a contraction of More-Vlakh—*i.e.* Sea-Vlaks—*Vlakh* being the same word as “Wallachian” and applied generally by the Slavs to peoples of Roumanian origin. Population 150,000, of whom two-thirds are Roman Catholics, the rest United Greek, but all addicted to many heathen practices.

Morland, GEORGE (1763–1804), a talented and prolific painter, was the son of a portrait-painter of the same name. He is said to have exhibited at the Royal Academy at the age of ten. As a young man he ran away to Paris. He then settled at Kensal Green, and married a sister of William Ward. Of his numerous pictures, most represent scenes from country life; but there are many sea-pieces. His *Farmer's Stable* is in the National Gallery, London.

Morley, HENRY, English writer, was born in London in 1822, and educated at King's College and in Germany. For some years he practised as a doctor in Shropshire, and afterwards kept a school, till in 1850 he began his literary career in London. He has written *English Writers*, *First Sketch of English Literature*, and other works, besides editing *Cassell's National Library*, the *Carisbrook Library*, and other cheap and useful reprints of classical works. From 1885 to 1889 he was professor of English language and literature at University College, London.

Morley, JOHN, was born in 1838 at Blackburn and educated at Cheltenham and Lincoln College, Oxford. He was called to the bar in 1873, but did not practise. Up to the year 1883 he was almost entirely engaged in literary and journalistic work. He conducted successively the *Literary Gazette*, the *Fortnightly Review* (1867–82), the *Pall Mall Gazette* (1880–83), and *Macmillan's Magazine*, and published several important works, the chief of which were *Burke* (1867), *Diderot and the Encyclopædists* (1878), *Cobden* (1881), *On Compromise* (1874), and *Walpole (Twelve English Statesmen)*. He also edited the *English Men of Letters* series. After two unsuccessful candidatures, he entered Parliament in 1883 for Newcastle, and in 1886

became Chief Secretary for Ireland, an office to which he was again appointed in 1892.

Morley, SAMUEL (1809–86), philanthropist, was born at Homerton, and became the head of a large hosiery business in the city of London. He represented Bristol as a Liberal from 1868 to 1885, and on his retirement declined a peerage. Himself a Congregationalist, the good work done by all churches and sects was supported by him. He contributed largely to the erection of the Memorial Hall in Farringdon Street.

Mormons, or LATTER DAY SAINTS, a religious community established in America by Joseph Smith. The capital, Salt Lake City, is a thriving town. The most remarkable doctrine of the Mormons is that which enforces polygamy. It has been the chief cause of the persecution to which they were formerly subjected and the animosity now felt towards them on the American continent. The sect is now said to number about 250,000 souls, less than half of whom are in Utah. A law condemning the polygamic habits of the Saints was passed by Congress in 1862, but remained a dead letter till 1882. Since that time it has been enforced, and the majority of the sect have now abandoned their peculiar views on this subject.

Morny, CHARLES AUGUSTE, DUC DE (1811–65), French statesman, was the adopted son of the Comte de Morny. His mother was said to have been Hortense, Queen of Holland. He served with credit as an officer in Algeria, and afterwards evinced considerable abilities as a financier. In 1842 he became a deputy, and in 1851 was one of the chief contrivers of the *coup d'état*, after which he was nominated by his supposed half-brother Minister of the Interior. He resigned office on account of the decree confiscating the Orleans property, but from 1854 till his death was president of the Corps Législatif.

Morocco, or MAROCCO (a corruption of *Marrakush*), the name commonly given to the north-western part of Africa, between Algeria and the Atlantic. The eastern boundary was settled by treaty in 1844, but the southern limits are undefined.

History. Morocco was for several centuries the

Roman province known as Mauritania Tingitana. In 533 Belisarius retook it from the Vandals; but a century and a half later the Eastern Empire was deprived of it by the Arabs. At the end of the 17th century Muley Ismaïl formed the present Empire. In 1769 the Portuguese evacuated Mazagan; but Spain still holds some places on the coast, Ceuta being the most important; Melilla she had to protect from Moorish fanaticism in 1893. In 1859-60 a war between the two countries ended in the discomfiture of Morocco.

Physical Features, etc. Northern Morocco is lined by the Atlas range of mountains, from which spurs shoot north, west, and south-west. Level, almost treeless, plateaus are found in the centre of the country, and in the south there is desert land. The streams are dangerous in the wet season, and almost dry at other times, and are quite useless for navigation. The Sebu, which flows westerly past Fez, is, however, an exception. The climate in the West is temperate, but in the south extreme. In the north there is a regular rainy season, but in the southern deserts little rain falls. In the region round Fez snow and ice are not infrequent. The soil, except in the desert regions, is, generally speaking, fertile, and in the west there is good pasturage. Wheat, barley, and maize are grown, as well as oranges, figs, lemons, dates and almonds. Tobacco cultivation is prohibited, but cotton and hemp are raised. Several minerals, including gold and copper, are said to be found in the interior; and silver is known to exist at Gondolfi, and rock-salt mines near Fez. Europeans are debarred from mining, and consequently little is done. The most characteristic of the animals are the Barbary deer and monkey, the wild cat and the porcupine. Locusts are all too plentiful, but Barbary horses are not what they were. The birds and fish, as well as the flora, are those of southern Europe.

Political and Social Facts. The aboriginal inhabitants are the Berbers, who live in the mountains in a half-savage state. Besides these are the Moors the Arabs proper, the Negroes, and the Jews. Some Spaniards also live in the towns on the coast. The empire of Morocco consists of the kingdoms of Fez and Morocco, and the territories of Sûs, Drâ, Wadi Tafilet, Tuat and others. The sultan is absolute, but often has to collect his revenues from the southern territories at the head of an army. The administration of justice is utterly corrupt, and all officers are at the mercy of the sultan, who indemnify themselves by oppressing inferiors. The army has recently been reorganised by Europeans. Education is very backward, and printing is unknown. There are no roads worthy the name; but the coast-towns are connected with Spain by telegraph. The chief industries are horse-and mule-breeding, the making of Morocco leather [LEATHER] and Fez-caps, carpet-weaving, and some jewellery and metal-working carried on by the Jews. Maize, fruits, cattle, beans, and eggs are exported. The slave-trade continues to flourish in spite of treaties and remonstrances. The sultan resides alternately at Fez, Makinas (Meginez) and Marrâkush, or Morocco. Chief among the other towns are Tangier, Tetuan, Sallee, and Mogador. Morocco

city (the second in population) is situated in the south-west about 300 miles from the coast, nearly 1,500 feet above the sea-level. It is surrounded by a wall of "tabia" (earth and lime) five miles in circumference, but low. It has seven gates and towers at regular intervals. Outside are eight large cemeteries. It was once a handsome and flourishing city, but has suffered much at the hands of the Berbers and others. It has a fine situation and a salubrious climate, and a fairly flourishing trade is carried on in the bazaar. There are several thousand Jewish inhabitants, but no Europeans. The sultan has a large palace outside the walls, but rarely occupies it.

Moroni, GIOVANNI BATTISTA, portrait- and historical painter, was born at Albino about 1510, and became a pupil of Il Moretto, the Brescian. Of his excellent portraits, *The Tailor*, in the National Gallery, is a good example. His pictures may be studied at the Brera Gallery, Milan, at Florence, Verona, Dresden, and Munich. He died in 1578.

Morpeth, a town in Northumberland, on the Wansbeck, 16 miles west of Newcastle. The principal buildings are the parish church (14th century); the town-house, designed by Vanbrugh and restored in 1870; and the King Edward VI. grammar school, rebuilt in 1859. Tanning, flannel-making, and brewing are the chief industries. By the first Reform Bill Morpeth lost one of its members.

Morphine, or MORPHIA ($C_{17}H_{19}NO_3$), an alkaloid which was first obtained from opium in the year 1807. It occurs in many plants of the order *Papaveracea*, usually in the form of soluble salts. It is obtained from opium by extracting with warm water and adding lime to the aqueous extract, by which means other alkaloids present are precipitated, and the morphine is left in the solution. It forms transparent crystals belonging to the rhombic system. It is only slightly soluble in water, but dissolves readily in solutions of alkalis. It acts as a strong base forming salts with acids, as *morphine hydrochloride* ($C_{17}H_{19}NO_3HCl3OH_2$). It possesses a bitter taste, and in small quantities acts as a narcotic, and in larger doses is a poison. It may be recognised by giving an orange colour with nitric acid, and a blue colour with *ferric* salts, which, however, disappears on addition of acids. Its recognition and estimation in poisoning cases, is, however, usually a matter of considerable difficulty. The hydrochlorate and acetate of this alkaloid are used in medicine, the former being administered in solution (*liquor morphinæ hydrochloratis*), and made up as a suppository and in the form of lozenges; the latter is also given in solution, and is the active ingredient in the *injectio morphinæ hypodermica*—a preparation administered subcutaneously. The hypodermic injection of morphia is a very useful preparation, and by means of it, the soothing influence of morphia upon the system can be produced without any disturbance of digestive processes such as results from the internal administration of opium. Treatment by hypodermic injection of morphia is, however, attended with danger, as a craving for the drug is

apt to be induced. This abuse of the employment of morphia has produced in not a few instances what is known as the "morphia habit." The subject of this condition becomes an absolute slave to the drug, and a peculiar tolerance of its poisonous properties is established, so that large doses can be taken without producing an immediately fatal effect. A condition of mental enfeeblement and moral perversion results in those who become confirmed victims of the habit.

Morphology, the science of organic form. The name, originally due to Goethe (1817), has been understood in widely different senses, being used sometimes as synonymous with anatomy (q.v.), sometimes for organography, sometimes for histology (q.v.), and sometimes for a more purely abstract discussion of form. Haeckel, in his *Generelle Morphologie* (1866), divides the subject into *teetology*, the study of organic individuality, and *promorphology*, the stereometry or crystallography of organisms. Promorphology is the attempt to reduce the complex-curved surfaces of organisms to definite mathematic expression. Two of the most remarkable instances of this are the laws of phyllotaxis (q.v.), and the law of the logarithmic spiral which governs the curvature of the shells of Gastropoda. The occurrence of comparatively precise geometric form among unicellular organisms has suggested that the excretion of silica to form the shells of diatoms or radiolarians may be determined by centres of vibration and rest in their protoplasm, similar to those in fine dust on a metal plate vibrated by a violin-bow. Morphology may also well be taken to include the discussion of the causes of modification of form, such as mechanical pressure or irritation, hypertrophy, atrophy, cohesion or chorisism, though these border on the provinces of physiology and pathology. The parallelisms of development in related organisms (*homology*), and in those adapted for similar surroundings (*analogy*), may also well find a place in this study.

Morris, GOUVERNEUR (1752-1816), American diplomatist, was born near New York. He began to practise as a lawyer in 1771, and ten years later was nominated by Robert Morris as assistant-superintendent of finance. He was one of the framers of the United States Constitution, but was in Europe from 1788 till 1798. He was in Paris during the earlier part of the Revolution, and in England as Washington's agent in 1791. From 1794 to 1798 he was United States Minister at Paris. After his return to America he became a United States senator. His *Diary and Letters* are important to the student of the French Revolution.

Morris, LEWIS, was born in 1833 near Caermarthen, and educated at Sherborne and Jesus College, Oxford, where he obtained two of the University prizes. He practised at the bar for about 20 years, and has more than once been an unsuccessful Liberal candidate for a seat in Parliament. His chief works are *Songs of Two Worlds*, *The Epie of Hades* (1876), *Songs Unsung*, *Songs of Britain*. In 1890 was published *A Vision of Saints*.

Morris, WILLIAM, was born in 1834 at Walthamstow, and educated at Marlborough and Exeter College, Oxford. He was afterwards articled to Street, the architect, and made some attempts at painting. In 1858, however, his *Defence of Guenevere and other Poems* showed his true vocation to be that of a poet. It was followed in 1867 by *The Life and Death of Jason*, and later by his masterpiece, *The Earthly Paradise* (1868-70). Mr. Morris has also published verse translations of the *Aeneid*, and the *Odyssey*, and some prose renderings (with Mr. Magnússon) of Icelandic sagas. Chief among his prose romances are *The Story of Sigurd the Volsung* (1878), *A Dream of John Ball* (1888), and *A Tale of the House of the Wolfings* (1889). In 1863 Mr. Morris founded with Rossetti, Burne-Jones, and others, an establishment for making wall-papers and stained-glass; and has since set up a printing-press. He has also taken an enthusiastic part in the Socialist movement.

Morris Dance, a rustic dance, probably of Moorish origin, and perhaps derived from the Spanish morisco or fandango. It became associated with the Robin Hood legend, the actors in which appeared in hoods and gowns ornamented with bells, and the hobby-horse was an invariable feature.

Morrison, ROBERT (1782-1834), Chinese scholar, was born at Morpeth. In 1807 he was sent by the London Missionary Society to Macao, and in 1814 translated and printed in Chinese for the East Indian factory at Canton, the New Testament. He was afterwards assisted by Dr. Milne in a Chinese version of the Old Testament. His life-work, however, was the *Chinese Dictionary*. After a two years' visit to Europe, he returned to China in 1826, and in 1834 was made interpreter to Lord Napier at Canton, where he died. Besides the works mentioned, he was author of a *Chinese Grammar*, *Horæ Sinicæ*, and also left *Memoirs*. His library was presented to University College, London.

Morris Tube, an inner tube of small calibre which can be temporarily fitted to the barrel of a breech-loading small arm or heavy gun, and from which a diminished bullet can be fired. The use of the tube enables ball practice to be carried on at times, in places, and under conditions which preclude the use of ordinary ammunition and large charges of powder. Its effects, moreover, a great saving of expense. The invention is, therefore, now generally used by the British navy and army.

Morse, SAMUEL FINLEY BREEZE (1791-1872), son of Rev. Jedidiah Morse, of Charlestown, Massachusetts, was a painter, sculptor, and architect before turning inventor. The idea of an electric telegraph came to him in 1832, when on a voyage between Havre and New York. In 1837 he took out a patent for an electric machine, and in 1844 sent a telegraphic message from Washington to Baltimore, and his system soon came into use in America and in Germany. Professor Henry, however, disputed with him the priority of the invention, while Wheatstone and others also took out independent patents at the same time. An international

present was given him in 1858 at the instance of Napoleon III.; his statue in bronze stands in New York. Morse also experimented in submarine telegraphy, and in 1857 attempted to lay a cable.

Morse Alphabet, a device, the invention of S. F. B. Morse, the American electrician, whereby the letters of the alphabet are expressed as combinations of dots and dashes, of short and long flashes of light, or of short and long whistles or other sounds. Originally introduced for telegraphic work, it is now of even greater importance for signalling purposes, especially in the navy, where it is used, particularly by night, as a means for communicating between ship and ship or between a ship and the shore.

Mortar. 1. A piece of heavy artillery, shorter than a howitzer, designed for throwing shells at high angles, and especially useful for the purpose of bombarding a town or fortress. Mortars of as much as 13 inches calibre were employed in the 18th century in the navy, and were generally mounted on platforms in bomb-vessels. They fired spherical shells weighing 195 lbs., with a bursting charge of 7 lbs. of powder. Mortars somewhat longer than those of the ancient pattern are now rifled and breech-loading, and the dividing line between them and howitzers is scarcely maintained.

2. A cement formed by a mixture of lime, sand, and water, which is used for cementing the stones, bricks, etc., in building, and for plastering walls, etc. On drying it sets, and in time becomes as hard as, or harder than, the cemented stones, with the formation of calcium carbonate from the lime. If silica is present to the extent of about 12 per cent. the mortar possesses the power of setting under water, and is known as *hydraulic cement*.

Mortgage, the grant of an estate or other immovable property in fee in security for payment of money, and on the condition that if the money be duly paid, the grant shall be void and the mortgagee shall reconvey the property to the mortgagor.

Mortification. [GANGRENE.]

Morton, JAMES DOUGLAS, 4TH EARL OF, inherited the Douglas estates through his wife. He joined the reformers in 1557, and became one of the "Lords of the Congregation," and in 1563 became Lord Chancellor of Scotland. He was engaged in the murder of Rizzio, and was cognisant of that of Darnley. He was also present at Carberry Hill and Langside; and it was he who announced the discovery of "the casket letters." For some years after 1572, when he became Regent, he was the most powerful man in Scotland; but he made many enemies, and in 1581 was beheaded for his share in Darnley's murder, which he always denied. [MARY STEWART.]

Morton, JOHN, CARDINAL, was born about 1420, and practised for some time as an ecclesiastical advocate. Though a Lancastrian, he was made Bishop of Ely and Master of the Rolls by Edward IV. He was imprisoned by Richard III., but escaped, and in 1486 was made Archbishop of Canterbury and Lord Chancellor by his successor, for

whom he devised the celebrated dilemma known as "Morton's Fork," by the application of which no one was able to evade taxation. He died in 1500.

Morton, THOMAS (1764-1808), wrote *Speed the Plough, Town and Country*, and other pieces popular in their day; JOHN MADDISON (1811-91), the author of the evergreen *Box and Cox* and numerous other farces, written between 1835 and 1885, held for some years a clerkship in Chelsea Hospital, and died a poor brother of the Charterhouse.

Mosaic Gold. This term is applied to two distinct substances: (1) to an alloy of copper and zinc in equal proportions, and (2) to a golden yellow mass of sulphide of tin, employed as a bronzing powder, and formed by heating a mixture of sulphur, tin-filings and sal-ammoniac.

Mosaic Work, or MOSAICS (mediaeval Greek, *mousaikos*, "artistic"), inlaid work formed by a collection of small pieces of some hard material, especially coloured stone or glass. The most ancient form of mosaic, specimens of which have been obtained from Nineveh and Egypt, was applied to the ornamentation of ivory furniture; in this work small pieces of glass, or lapis lazuli, are placed in holes separated only by thin partitions. At a later date mosaics were used on a much larger scale. After a period of decline from the 8th to the 11th century the art revived, reaching its full development in the 13th century, when the beautiful designs in the apse of S. Maria Maggiore, at Rome, were executed by the disciples of Cimabue. In the next century, however, the art fell into neglect owing to the revival of painting, and the introduction of frescoes. At the present time the making of mosaics is a successful industry in Italy and France and, to some extent, also in Russia.

Mosaylima (MOSEILEMA), a rival of Mohammed, belonging to a division of the tribe of the Beni Hanifah. He seems to have had some position as a religious teacher before, in the ninth year of the Hegira, he came to confer with the prophet. He afterwards demanded that the latter should share half the earth with him; and Mohammed appears to have been obliged to purchase his support by conceding some authority to him. He is also said to have nominated him as successor; but, if so, his followers did not fulfil his wishes, for Abu Bekr sent a force against Mosaylima, and a terrible battle ensued, in which the latter fell.

Moscheles, IGNAZ (1794-1870), was born at Prague. At the age of fourteen he played one of his own compositions in public, and he rapidly became the best pianoforte-player of his day. For nearly twenty years he lived in England, where he was ultimately connected with the Philharmonic Society, but in 1846 became pianoforte professor at the Leipzig Conservatorium. Among his best compositions were *Hommage à Händel* (duet for piano), twenty-four études, and several concertos and sonatas.

Moschus, a Greek bucolic poet who lived at Syracuse about 200 B.C. His chief works are the epitaph on Bion, two small epics (*Megara* and *Europa*), and an epigram styled *Love the Runaway*.

Moscow, the old capital of Russia and chief town of a government of the same name, stands on high ground on the banks of the Moskwa river, 400 miles south-east from St. Petersburg and about twice that distance north-east of Warsaw. While under the rule of the princes of Vladimir in the 13th century it was twice plundered by the Mongols. In the 17th century the city was the scene of frequent struggles between the Tzar and the citizens, and later of the rebellions of the *Streltzy*. The last of Moscow's many misfortunes was when, in 1812, it was thought necessary to fire the city in view of the advance of the grand army of Napoleon. The present city covers an area of 32 square miles. In the centre, on the left bank of the Moskwa, stands the Kremlin, a fortified space covering 98 acres and surrounded by a high stone wall. It has five gates over which are as many towers. Within the Kremlin stands the Uspensky cathedral, built in the 15th century and subsequently restored. The Arkhangelsk cathedral, erected on an old site in 1505, contains the tombs of the Tzars from 1353 to 1696. The campanile of Iwan Veliky contains some fine bells, and commands a magnificent view of the city. The Great Bell of Moscow hanging nineteen feet high and weighing 3,850 cwts. is close by. It was broken in the fire of 1737 before being hung. An exchange was built in 1838, and restored in 1873. Moscow is the centre of a large trade in grain, hemp, and oils. It has numerous cotton-mills, and woollen and silk manufactories; sugar-refining is largely carried on; and the empire is supplied from it with groceries, tallow, timber, etc. It is situated at the junction of six important highways, and is the centre of six railway systems. The university, founded in 1755, has between 2,000 and 3,000 students, and upwards of 300 teachers. There is also a good technical school, an Oriental institute, an agricultural college, and many other educational institutions. Moscow is also rich in museums and scientific societies, among which may be mentioned the active Archæological Society (founded 1864), and the Society of the Friends of Natural Science. Chief among philanthropic institutions is the Foundling Hospital built in 1764. The Moscow theatres are the best in Russia. The suburbs contain some fine parks. To the north and west are woods and forests, among which are some historical monasteries and palaces.

Moselle, THE RIVER, rises in the Vosges mountains, and flows north-westerly till reaching Toul, after which it takes an easterly turn and traversing Luxemburg and Rhenish Prussia enters the Rhine at Coblenz. It has a total course of 315 miles, in about a third of which it is navigable. The Meurthe is the chief tributary on the right, and the Orne on the left. Metz, Thionville, and Trier (Trèves), are situated on its banks. The country through which it flows is celebrated for its wines.

Moses (Heb. *Môsheh* = "drawn"), the law-giver of Israel, lived probably in the 14th century before Christ, and is said to have attained the age of 120 years. According to the Biblical account he led his people out of Egypt through the desert,

but himself died in sight of the Promised Land, and also gave the law from Mount Sinai, and extended and reformed the national system of the Israelites. There are many traditions as to his life in the writings of Philo and Josephus. The *Hexateuch* (the so-called "Books of Moses" and the early part of the Book of Joshua) were long accepted as his work, but many critics now place them, at all events in their present form, many hundred years later. See the writings of Wellhausen and Kuenen.

Mosheim, JOHANN LORENZ VON (1694-1755), the German ecclesiastical historian, was born at Lübeck. After holding the chair of theology at Helmstedt for several years, he became professor at Göttingen and chancellor of that university. His greatest work was the *Institutiones Historiæ Ecclesiasticæ*, finished in 1726, and re-issued in 1755. In 1832 it was translated into English by Dr. James Murdock. He wrote several other works on theology and Church history.

Mosques, the name given to Mohammedan places of worship. They were originally built in imitation of the Christian basilicas (q.v.), but in process of time the construction became completely altered. The main building is a square structure surmounted by a dome which rests on pendentives. In front of the chief gate is a rectangular court surrounded by cloisters, with a fountain for ablution in the centre. Within the domed building numerous lamps are hung, and the whitewash which forms the ordinary covering of the walls is relieved by arabesques and sentences from the Koran, but all representation of men and animals is forbidden. In the south-east stands a pulpit (*nuinbar*), and a niche (*nishrah*) indicates the direction of Mecca, towards which the faithful turn when they pray.

Mosses (*Musci*), the higher class of the sub-kingdom Bryophyta (q.v.), are lowly plants, found in most situations, but most abundant in damp places in temperate climates. The green unicellular spore, on germinating, gives rise to a green filamentous, branching *protonema*, on which arise lateral buds, which grow into the leafy shoots. The stem generally terminates in a three-sided, pyramidal, apical cell: its outer cells are thickened into a red or yellow epidermal layer; and in some cases there is also an axial, rudimentary "vascular bundle" of elongated cells. The numerous small, spirally-arranged leaves are mostly a single layer of cells; but there is a thicker midrib, sometimes produced into an awn, and having its cells continuous with those of the axial bundle. Bog-moss (q.v.) and *Leucobryum* are exceptional in having a system of large, empty, perforated cells, acting as a capillary water-conducting apparatus, both outside the epidermis of their stems, and in their leaves, giving the plant a light-greyish aspect. Mosses generally put out numerous *rhizoids* or root-hairs, differing from *protonema* in being colourless and growing downwards. Branches generally originate beneath the leaves, and becoming detached by the decay of their bases, serve

to reproduce the plant, under the name *innovations*. *Gemmae*, or multicellular bud-like bodies, are frequently borne by mosses, sometimes in a distinct receptacle or *cupule*, and reproduce the plant asexually. The sexual organs are commonly surrounded by a rosette of leaves termed *perichæ-tial*, and thus form what is called a *flower*, which may be bisexual, monœcious, or diœcious, and contains barren cell-filaments or *paraphyses*, in addition to the archegonia (q.v.) and antheridia (q.v.), assisting fertilisation by retaining drops of water. Mosses are divided into *Acrocarpi* and *Pleurocarpi*, according as the apical cell of the main stem or that of a side-branch gives rise to the archegonium. Mosses are divided into four well-marked orders, *Sphagnaceæ*, *Andreaeaceæ*, *Phascaceæ*, and *Bryaceæ*. *Sphagnaceæ*, the bog-mosses, have globular red capsules, with a very short seta, but a long stalk or *pseudopodium* below it, belonging to the oophore stage. There is a small convex lid or *operculum* to the capsule, and within there is a globular mass of tissue or *columella*, in the upper part of which spores of two sizes (*megaspores* and *microspores*) originate. The *Andreaeaceæ*, containing only the genus *Andreaea*, have no operculum, the capsule otherwise resembling that of bog-mosses, but bursting by longitudinal splits. *Phascaceæ*, also a small order, approximating in some points to the liverworts, have a sporangium which decays without bursting. *Bryaceæ*, the largest and highest order, have a pointed operculum, below which is an *annulus* or ring of hygrometric cells. There are commonly stomata on the lower part of the capsule, and there is an axial *columella* throughout its interior. The spore-bearing tissue surrounds this column and is separated from the outer walls of the capsule by an air-cavity crossed by rows (*trabeculae*) of green cells. Generally, when the operculum falls, the mouth of the capsule is seen to be surrounded by one or two rows of teeth-like bodies (*peristome*) which are much used in discriminating genera.

Mosul, a town in the province of Al Jezireh, Turkey in Asia, stands on the right bank of the Tigris opposite the ruins of Nineveh. In the 9th century it was a flourishing trading city, and had previously been a great Christian centre. It was occupied successively by the Mongols, the Seljuks, and the Turks, and has long been in a declining state. A memorial of Mosul as a commercial town remains in muslin, which took its name from that of the place where it was made.

Motett. (1) A sacred cantata, comprising various unconnected movements. (2) A choral composition, usually sacred, in which the introduction, resembling a song in form, is followed by fugue subjects, with their expositions.

Mother Carey's Chicken, the sailor's name for the Stormy Petrel, the Great Black Petrel being called, from its size, Mother Carey's Goose. "Mother Carey" is said to be a corruption of *mater cara*.

Moths, the name given to those insects belonging to the group Heterocera, one of the two subdivisions of the order Lepidoptera (q.v.). The

classification is at present somewhat unsatisfactory, but they may be divided into 5 sub-sections and about 120 families. The *Sphinges* (Hawk-moths), the *Bombyces* (containing the Tiger-moths and Silkworms), the *Noctua* (containing the Cabbage-moths), the *Geometrae* (with the Swallow-tailed moth), and the *Microlepidoptera* (of which the Clothes-moth is a type), form the sub-sections.

Motion may be of two kinds. If a body moves from one position to another in a straight line, it is said to have a motion of *translation*; if it moves round a fixed point, it is said to have a motion of *rotation*. However complex the motion of a body may appear to be, it can always be shown to be a combination of these forms. When a body moves through equal distances in equal times, its motion is said to be *uniform*; but if it gains or loses speed, its motion is *variable*, and the speed gained in unit time is called its *acceleration*. Thus, if a body is moving with a speed of 44 feet per second and during one second increases from 44 to 50 feet per second, it has an acceleration of six feet per second. We can only consider relative motion, for we know nothing about the absolute motions of bodies in space. In saying that a train moves at the rate of 30 miles an hour, we are merely comparing its speed with that of the places it passes on the earth, and we entirely neglect the earth's motion round her axis or round the sun, which motion belongs alike to the train and the places on its route. Newton enunciated three laws of motion:— (1) Every body remains in a state of rest or of uniform motion in a straight line, unless it is compelled by impressed forces to change that state. This is equivalent to saying that matter has inertia; it cannot, by itself, change its state of motion. (2) Change of motion is proportional to the impressed force, and takes place in the direction of the straight line in which the force acts. From this it at once follows that when several forces act on a body, each produces the same effect as if it acted alone, and this effect is produced whether the body be already in motion or at rest. (3) Action and reaction are equal and opposite, or the mutual actions between any two bodies are always equal in magnitude, but oppositely directed in the same straight line. Thus, the tension of a rope is the same throughout its length; it exerts, for instance, as great a pull on the towing-line as on the boat which is towed. The action and reaction can be expressed as the work done by a force; hence, we arrive at the principle of "natural work" and its application to machines. The third law may further be regarded as the first enunciation of the principle of the indestructibility or conservation of energy.

Motley, JOHN LOTHROP (1814-77), the American historian, was born at Dorchester, Massachusetts. After leaving school he went to Harvard, where he graduated in 1831. His education was completed in Germany. In 1837 Motley was married, and two years later published an historical novel. In 1856 he made his reputation by the publication of his *History of the Dutch Republic*, which had taken him ten years to write. It was

followed by the *History of the United Netherlands*, the last part of which appeared in 1868, and by *The Life and Death of John Barneveld*. During the Civil War Motley wrote some interesting letters to the *Times*. He was United States minister at Vienna from 1861 to 1868, and in the following year was transferred to Great Britain, but was recalled almost immediately on account of his friendship with Sumner, with whom President Grant had quarrelled. He died, however, in England.

Mouflon. [SHEEP.]

Mould, a general name for a variety of fungi (q.v.) belonging to several orders mostly low in the series. They have mostly a filamentous or felt-like spawn or *mycelium*. Thus the name might be applied to the "white rust" of cruciferous plants (*Cystopus candidus*), the potato disease (q.v.), or the salmon disease (*Saprolegnia ferax*), among the Oomycetes; or to the mildew (q.v.) (*Puccinia graminis*) among the *Æcidiumycetes*. It is, however, more commonly applied to *Mucor* and its allies, among the Zygomycetes, and to *Eurotium*, *Penicillium*, and allied forms, among the Ascomycetes. *Mucor mucedo* is the common white mould on fruit, jam, decaying mushrooms, horse-dung, etc.; *Eurotium herbariorum*, formerly known as *Aspergillus glaucus*, the green mould on bread; and *Penicillium glaucum*, the common blue mould. In saccharine liquids *Mucor* breaks up into detached round cells resembling yeast both in form and function. Moulds, while sending their ramifying mycelium through the substratum on which they feed, generally soon send upward erect spore-bearing branches (*conidiophores*), the spores on which (*conidia*) become detached and rapidly spread the growth of the mould from new centres.

Moulding, a general name for the varieties of outline given by carving to the angles of certain parts of a building, such as cornice, capitals, base, etc. In classical architecture the mouldings are comparatively few, their form is always the same, and each has its fixed place in the order. Mediæval architecture forms a great contrast to Classical in this respect. The general contour of Norman mouldings is very simple, but the surface ornament gradually becomes extremely rich and varied. Each of the Gothic styles has its characteristic mouldings, which are the best indications of the date of a building. [GOTHIC ARCHITECTURE.]

Moulins, a town in the department of Allier, France, stands a little to the east of the river of that name, 124 miles N.W. of Lyon. It has a cathedral, part of which dates from the 15th century, and a square tower, belonging to the ancient castle of the Dukes of Bourbon. Here Villars and the Duke of Berwick were born, and Clarendon wrote part of his *History of the Great Rebellion*.

Mound Birds, a name for the gallinaceous family Megapodidæ, from the Oriental and Australian regions, from their habit of constructing large mounds of soil and leaves, in which the eggs are deposited and hatched by the heat of the decomposing vegetable matter. The birds of the

type-genus *Megapodius*, about the size of small fowls, are, with one exception, of sombre plumage; the head is usually crested, the tail small, and the feet enormously developed. [BRUSH-TURKEY.]

Mound Builders, a term applied to the unknown race or races who raised the numerous tumuli, forts, and other structures scattered over the Mississippi basin and other parts of the United States, but especially numerous in the southern parts of Ohio. Here Moorehead recognises two distinct mound-building races, the old long-headed and the later intruding and conquering round-headed, besides traces of a still earlier palæolithic people near Cincinnati, possibly contemporaries of the mastodon, megatherium, mylodon, and huge extinct bears and jaguars. The chief seat of the long-heads was the Muskingum Valley from Marietta upwards to East Ohio, where the mounds, differing in type from those of the round-heads, have yielded pottery, articles of slate, hematite, copper bracelets, and other ornaments, some well made but generally inferior to those of the round-heads. This race had their chief centre in the Madisonville district at the head of the Ohio river, where have been found superior copper, horn, flint, stone, bone, and shell objects in great number. Some 24 miles to the north-east are the earthworks of Fort Ancient, the largest in Ohio, nearly a mile long and with over ten miles of artificial work. Chillicothe, on the Scioto river, is still the centre of the most interesting round-head remains, such as the Hopewell group, the Hopeton works, the Mound City, and other sites of pre-Shawnee settlements, yielding potteries of artistic designs and elaborate workmanship, finely-chipped flints, copper objects, etc. Moorehead concludes that none of the mound-building races attained more than a high state of savagery, that they were skilled in several arts, but excelled in none, not even semi-civilised, much less possessors of the "lost civilisation" with which they have been credited. The best authorities, in fact, now regard them, not as a distinct race, but merely as the precursors or ancestors of the present aborigines. (W. K. Moorehead, *Primitive Man in Ohio*, Boston, 1892.)

Mounds, a general term, including barrows or burial-mounds, denoting the elevations raised to commemorate some notable event, or the strange earthworks representing animal forms and probably connected with animal worship. [BARROW, MOUND-BUILDERS.]

Mountain, a term somewhat loosely applied even by geologists, but perhaps capable of being restricted to two classes of elevated portions of the earth's surface, as opposed to *hills*, which form a third class. If *hills* be taken simply as elevations due to denudation—i.e. to the more extensive wearing away of the surrounding land—mountains may be either of *accumulation* or of *elevation*. Mountains of accumulation are simply those originally conical heaps of cinders bound together by penetrating dykes of lava which we know as volcanoes (q.v.). Mountains of elevation generally occur in lines—often not continuous, but *en échelon* or overlapping—which are known as *mountain-chains*.

These often coincide in direction with continental areas; but even in such cases as the Andes and the Himalayas the bulk of the chain may be of comparatively modern geological date. It is of the essence of a true mountain-chain that its rocks have undergone tilting, folding, or at least actual upheaval. The chain may be the result of one movement or of a series of movements in one age; but more often it is the result of a long succession of movements in various ages. Originating along a line of weakness in the cooling crust of the shrinking globe, it has again and again been crumpled upwards under the strain of compression. The crest of one fold has often been planed off by denudation and subjected to such a depression as to allow other rocks to be deposited across its denuded edges. [UNCONFORMABILITY.] These rocks may in their turn have been folded, planed and covered, and so on, at long intervals of geological time.

Mountjoy, CHARLES BLOUNT, eighth LORD (1563-1606), took part, as a volunteer, in the engagement with the Armada, and was in 1594 appointed governor of Portsmouth. He was sent to Ireland by Elizabeth in 1600 to succeed Essex, where he restored peace. He wrote on military subjects.

Mouse, a popular name for many of the smaller species of the sub-family Murinæ, of the family Muridæ, to which more than a third of the Rodents belong. The Common Mouse (*Mus musculus*), originally Asiatic, has followed man in his wanderings all round the globe, and is too well known to need description. Besides the Rat (q.v.), two other species are British—the Harvest Mouse (*M. minutus*), which brings forth and rears its young in a round nest of grass and reeds, and the Wood or Long-tailed Field Mouse (*M. sylvaticus*). There are several other sub-families, of which one, the Voles (*Arvicolinæ*), has British representatives. [DEER-MOUSE, HYDROMYS, SHREW, VOLE.]

Moxa, a method of applying counter-irritation by burning some inflammable material upon the skin and so producing a sore. This antiquated method of treatment is now rarely or never used.

Mozambique, the name of a Portuguese province on the eastern coast of Africa, extending from Cape Delgado to Delagoa Bay. Mashonaland and the Transvaal Republic touch it on the west. The country is watered by the Rovuna, the lower waters of the Zambesi, the Sabia and the Limpopo. The soil is rich; and maize, cotton, rice, sesame, and indiarubber are grown. The last-named, with ivory and ground-nuts, is exported. Minerals of all kinds exist, but little is done to obtain them; and the same is true of the pearls which abound on the coast. Customs duties are very heavy. The province of Mozambique is under a governor-general and two councils, and the nine districts have each a subordinate governor. Chief towns, Quilimane, Lourenço. Marques, and Mozambique. The last named, situated on a coral island, has a fort (built by Albuquerque), cathedral, and Government-house. It was once a great centre of the slave-trade.

Mozart, JOANNES CHRYSOSTOMUS WOLFGANG AMADEUS (1756-91), was born at Salzburg. His first appearance in public was in a comedy of Eberlin's, performed in the hall of the university of Salzburg when the young musician was only five years old. In the following year (1762) Mozart's father took him and his sister Marianne on a musical tour. In February, 1765, two concerts were given in London in which all the overtures were of the boy's own composition. Mozart was on his return put to study by his father, and at the end of 1768 he conducted some sacred music of his own composition before the emperor. A year later he left Salzburg for a tour in Italy. At Milan an opera of Mozart's was received with immense applause, and he was commissioned to write several others. In March, 1771, the Mozarts returned to Salzburg, where for the next few years Wolfgang was busy composing symphonies, concertos, masses, and serenatas, and in studying the works of other masters. In 1777 he set out with his mother for Paris. At Mannheim he fell in love with Aloysia Weber (afterwards, as Madame Lange, a great singer), whose sister Constanze he afterwards married. As his mother died after a few months, Wolfgang left Paris, and in June, 1779, was again in Salzburg. In 1781 he was entrusted with the composition of a grand opera (*Idomeneo*) for the Munich carnival. Soon after this he finally threw up his position as concert meister to the Archbishop of Salzburg. In 1782 his opera *Die Entführung aus dem Serail* was produced with great success at Vienna. The extraordinary popularity of *Don Giovanni* caused the Emperor Joseph to make him "Kammer-Musicus" at £80 a year. *Don Giovanni* (1788) had been preceded by *Le Nozze di Figaro* (1786). Though these operas had gained Mozart a great reputation, he was to the end in straitened circumstances. Nevertheless, when Frederick William II. of Prussia, after the composer's visit to Berlin in 1789, offered him the post of kapellmeister at a reasonable salary, he declined rather than abandon "his good emperor." The latter, in return, ordered Mozart to compose a new opera. This was *Così fan Tutte*. Under Leopold II. Mozart received the reversion to the kapellmeistership of the cathedral, but did not live to enjoy it. His last compositions were *Il Flauto Magico* (*Der Zauberflöte*), and a Requiem, the last being written for a certain Count Walsegg, and produced as the latter's own work. Mozart's best works besides his great operas are some symphonies and masses. He was master of the organ, violin, and piano, his playing on all of them arousing extraordinary enthusiasm.

Mozley, JAMES BOWLING (1813-78), theological writer, was educated at Oriel College, Oxford, and became fellow of Magdalen and Regius Professor of divinity. He also held a canonry at Worcester. Chief among his works are his Bampton lectures on *Miracles* (1865), his *Theory of Development*, in answer to Newman, and *Essays, Historical and Theological* (1871), written in a scholarly but ultra-conservative vein.

Mucilage, a term formerly confined to the

vegetable gums which are obtained from plants by extraction with water, but it is now usually used for any viscid solution of gummy material.

Mucin, a proteid material, found in the mucous secretions of animals. It may be obtained, from such sources, as a white mass which is slightly soluble in water.

Mucous Membrane. The mucous membranes form the internal lining of certain cavities in the body. The *mucous membrane of the digestive tract* extends from the mouth throughout the whole length of the alimentary canal, and is more particularly described under DIGESTION (q.v.). The *mucous membrane of the respiratory tract* lines the larynx, trachea, and extends along the bronchi into the pulmonary cells. [LUNGS.] The *genito-urinary tract* is also lined throughout by mucous membrane.

Mud-Fish, any fish of the order Dipnoi, or Double-breathers, which have lungs as well as gills, the heart showing affinities with the amphibians, and the paired fins with a central axis. There are two genera: *Ceratodus*, from Queensland, and *Protopterus*, from tropical Africa. Both are esteemed for the table. *C. forsteri*, which attains a length of about six feet, is a vegetable feeder. It is said to leave the water at night, but probably does not travel far, owing to the weakness of its limbs. The *Lepidosiren* of zoological gardens (*P. annectens*), which has external gills, lives on small fish, frogs, and insects. When the streams dry up these fish bury themselves in balls of mud, and become torpid. These balls have been dug out, and sent to Europe and America, where the fish have revived after a short immersion in water. *Lepidosiren paradoxa*, described by Natterer, from the Amazons, is probably a species of *Protopterus*. The name Mud-fish is also given to some other fish that bury themselves in the mud, notably to the North American bow-fin (*Amia calva*), a ganoid in which the swim-bladder is cellular, and performs to some extent the functions of a lung.

Mud Volcanoes are generally small conical hills of mud with a crater at the top, giving off steam or other gases with the mud. In Sicily they are known as *macalubas*, and have been explained as due to the slow combustion of beds of sulphur. The gases emitted are carbon-dioxide (CO_2), carburetted hydrogen (CH_4 and C_2H_4), sulphuretted hydrogen (H_2S) and nitrogen, and the water often contains salt, when the volcanoes are termed *salses*. They occur in Iceland and the Yellowstone Park, at Baku on the Caspian, and in the regions of the Lower Indus, where some of them reach 400 feet in height and have craters 90 feet across.

Muezzin, the Arab who, from his station on the minaret in the precincts of the mosque (q.v.), summons the faithful to prayer.

Mugwump (Algonquin *mugquomp*, "a chief") denoted originally an Indian chief, hence a person of importance, and so a self-important person. The name was applied to the Republicans who, during the United States presidential election in 1884, supported the Democratic candidate, Mr. Cleveland, in

preference to the nominee of their own party, and is often used in the general sense of a person of independent views.

Mühlhausen, a manufacturing town in the district of Erfurt (Thuringia), North Germany, on the right bank of the Unstrut, 25 miles N.W. of Gotha. It became important in the 10th century, was the centre of Anabaptism after the Reformation, suffered much in the wars of the 18th century, and was ceded to Prussia in 1815. The weaving of cotton and woollen goods is the chief industry. Prosperous and well-built suburbs have grown up round the old town, which contains, among many ancient structures, the churches of the Virgin and St. Blasius, and a fine town-hall.

Muir, JOHN, born at Glasgow in 1810, entered the Bengal Civil Service in 1828, and held various positions of importance, acting for a time as principal of the Victoria College, Benares. His most important work, however, was literary and social rather than administrative. He was one of the first practical Sanskrit scholars, and he did much to break down by means of education the barriers that separated the Hindu from the rest of mankind. On his retirement in 1853 he devoted himself to editing the Vedic texts, producing a monument of patient industry. He also founded a chair of Sanskrit in Edinburgh University before his death in 1882.

Muir, SIR WILLIAM, K.C.S.I., was born at Glasgow in 1819, and entered the Bengal Civil Service in 1837. After passing through the usual stages of promotion, he became Lieutenant-Governor of the North-West Provinces in 1868, member of the Viceroy's Council in 1874, and member of the Council of India in 1876. He resigned this position on being appointed principal of the university of Edinburgh in 1885. He has written *The Life of Mahomet*, *Annals of the Early Caliphate*, *The Korân and the Testimony it bears to the Holy Scriptures*, and *A Translation of Extracts from the Korân*.

Mukden, or TUNGTIEN-FOO, or SHING-YANG, the capital of the province of Shên-king, Manchuria, China, is a walled town on a branch of the river Leaou, 500 miles N.E. of Peking. It contains a summer palace of the emperor, and does a considerable trade with the neighbouring provinces through the port of New-Chwang or Yingtze.

Mulberry, a group of trees belonging to the genus *Morus* and the allied *Bronssonetia* in the order Moraceæ, a group of the Incompletæ (q.v.), allied to the nettle, hemp, and elm families. *M. nigra*, the black mulberry, mainly cultivated for its fruit, is perhaps a native of Armenia, but was early introduced into Greece, where its leaves are still used for feeding silkworms. It was perhaps introduced into England from Lombardy during the reign of Edward VI. The Asiatic species, *M. alba*, the white mulberry, of which there are numerous varieties, mostly with white fruit, is that mainly cultivated in Japan, China, India, and Italy, for the silkworm. The fibrous inner bark of *Bronssonetia papyrifera*, the paper mulberry, is made into paper by the Chinese and Japanese, and into

tapa cloth in the South Sea Islands. Mulberries are easily propagated even by large woody cuttings. The so-called fruit is formed from a whole cluster (*raceme*) of flowers, the perianth-leaves of each of which becomes fleshy, turn colour, and sweeten while they enlarge until they meet those of the other flowers, enclosing the true fruits, small dry capsules. [INFRUITESCENCE.]

Mulcer (MULCHER), a low-caste people of the Anamalah Hills, south India; almost black with wavy and curly hair and frizzly beard, altogether resembling the Aeta (Negrito) aborigines of the Philippine Islands, and evidently representing the primitive black element in India; present speech a Malayalim (Dravidian) dialect.

Mule, a hybrid of which the sire is an ass and the dam a mare. [HINNY.] Mules have been bred from an early period, and are highly valued in many parts of the world for draught and burden. In England they are chiefly used for draught; some trainway companies use them for their cars, and their powers of endurance make them valuable for many purposes, especially in war-time. They are largely bred in France, Spain, and Italy and in some of the states of the American Union, and in South America they are replacing the llamas as beasts of burden, chiefly on account of their sure-footedness. The fertility of mules is an unsettled question. Sir William Flower asserts that female mules are fertile with the males of either species; and Professor Wallace extends this to female hinnies, adding that the foal of the mule is seldom born alive; but neither adduces evidence in support of these statements.

Mülhausen (French, *Mulhouse*), the chief manufacturing centre of Upper Elsass, Germany, stands between the river Ill and the Rhine-Rhone Canal, about 56 miles S. of Strasburg and 18 miles N.W. of Basle. Founded in the 7th century, it was for many centuries an independent free town, in league from 1446 with Switzerland. It became incorporated with France in 1798, but passed to Germany in 1871. Printed cottons, silk, muslin, and some qualities of woollen and mixed fabrics are largely manufactured, and large works exist for the construction of locomotives and other machinery. The old town-hall (1552) is almost the only relic of mediævalism. The industrial quarter, founded in 1853 by John Dollfuss, is in many respects a model of organisation, and the *Société Industrielle* has done much to improve the condition of artisans.

Mull, an island forming part of Argyllshire, Scotland, being the largest of the Inner Hebrides, with an area of 235,000 acres, mostly rugged, mountainous, and barren, but affording pasture to sheep and black cattle. Ben More, in the centre, rises to 3,185 feet, and the coast to the W. is indented by Lochs Na-Keal and Scridain. There are everywhere traces of volcanic action, the margin presenting terraces of basaltic rocks, whilst the internal valleys are filled up with lava and ashes of the Miocene period, but Old Red Sandstone is the principal formation. Tobermory, in the Sound of Mull, affords a safe harbour, and possesses a

number of herring boats. Kelp-gathering gives employment to the poorer inhabitants.

Mullein, the English name of the genus *Verbascum*, herbaceous plants belonging to the order Scrophulariaceæ. There are nearly 100 species, widely distributed throughout the temperate regions of the Old World; and six species, besides various hybrid forms, are indigenous in Britain. *V. Thapsus*, the great mullein, sometimes three or four feet high, is also known as Hag-taper, Adam's Flannel, or Bullock's Lungwort, from its growing in hedgerows (Anglo-Saxon, *hæga*) and from its woolly leaves being used in rustic veterinary practice.

Müller, JOHANN. [REGIOMONTANUS.]

Müller, JOHANN VON, born at Schaffhausen, Switzerland, in 1752, and educated at Göttingen, became Professor of Greek in his native town, but devoted his best energies to historical research. In 1772 he published his *Bellum Cimbricum*, followed by *Vierundzwanzig Bücher allgemeiner Geschichte*, which he wrote at Geneva. It was not until 1780 that the first volume of his *History of the Swiss Confederation* made its appearance, and the fourth and concluding volume was delayed until just before his death. Meanwhile he had passed from Geneva to Cassel and from Cassel to Mainz, where the Elector had given him political employment and rank. For twelve years he was established in Vienna, having work in the Imperial Library, but in 1804 he was called to Berlin as historiographer and councillor of war. Finally, in contradiction to all his previous opinions, he received from Napoleon in 1807 the post of Secretary of State in Westphalia, and died two years later. Among his other works may be named *Reisen der Päpste*, *History of Frederick II.*, and an edition of Herder's writings.

Müller, JOHANNES, was born at Coblenz in 1801, received his education at Bonn, and became professor of physiology there in 1830. Three years later he was promoted to a similar post in the university of Berlin, where he worked until his death in 1858. His *Elements of Physiology*, completed in 1840 and translated into English by William Baly, marked a scientific epoch, and has influenced all subsequent investigators.

Müller, KARL OTFRIED, born in 1797, and educated at Breslau and Berlin under Boeckh, showed a strong taste for Greek literature, publishing, in 1817, his first work, *Ægineticorum Liber*, which gained him an appointment at Breslau, whence he passed in 1819 to Göttingen as professor of archæology. Müller's idea of reconstructing a mental picture of Greek civilisation was carried out in a very able series of books, of which his *Dorians*, *Orchomenos and the Minyans*, *Etruscans*, *Prolegomena to Scientific Mythology*, and *History of the Literature of Ancient Greece* are the most widely known. In 1839 he obtained leave to go on a tour in Greece, and, whilst excavating at Delphi in 1840, caught fever, of which he died.

Muller, WILLIAM JAMES, was born in 1812, and, after a good general education, was taught

painting by Pyne. At first he occupied himself with Gloucestershire scenery, but the subject of his first Academy picture in 1833 was *The Destruction of Old London Bridge*. His work found appreciation at modest prices, *The Chess Players* bringing him but £25, though it has since been sold for £4,000. In 1841 appeared his able sketches *The Age of Francis I. of France*, and in 1843 he went into Lycia with the exploring commission. His health failed, and he returned home to die in 1845.

Mullet, any fish of the type-genus *Mugil*, Acanthopterygian family Mugilidæ, in which the body is compressed and has no lateral line. There are about 70 species from the coasts of tropical and temperate seas, and many live in brackish water. They feed on the organic matters in mud and sand, the top of the gullet being modified to form a kind of sieve. These fish, popularly known as *grey mullets*, from their coloration, are used for food, some of the estuarine species being esteemed. Dr. Günther suggests that it would be profitable to rear them in artificial backwaters for the market. *M. capito* is the common *grey mullet*, and other species occur on our coasts. Red mullets belong to the genus *Mullus*, the type of a family allied to the Perches, and having many species, mostly tropical. The European species (*M. barbatus*) occurs on our southern coasts, and is highly valued as a delicate food-fish. The male is smaller than the female, which was formerly described as a distinct species (*M. surmuletus*), and is popularly known as the surmullet.

Mullion, in Gothic architecture, a slender pier or vertical bar of stone separating the lights of windows, etc., different from the transom (q.v.), which is horizontal. They arose in the Early English style; as the group of two or more windows placed close together was formed into a single window containing two or more lights, the separating pieces of wall became mullions.

Mulready, WILLIAM, born in 1786, came as a child to London with his father. Through Banks the sculptor he was admitted in 1800 to the Royal Academy schools, and in 1804 he became an exhibitor. His first works were landscapes, but in 1807, after a course of popular book-illustration, scene-painting and so forth, he settled down as an interpreter of every-day English life. *Old Caspar* was the first of a long series of works extending over half a century, and including *Idle Boys*, *The Fight Interrupted*, *The Barber's Shop*, *Train Up a Child*, *Choosing a Wedding Gown*. The National Gallery has four of his works. He worked in the Royal Academy schools to within two days of his death in 1863. The "Mulready envelope," the first envelope devised for the penny post, was designed by him, and introduced in 1840, but soon discontinued.

Multan, or MOOLTAN, a district and its capital in the Punjab, British India. The former lies between the rivers Sutlej and Chenab, with an area of 5,880 square miles. Along the river banks stretches a fertile strip which under careful irrigation yields heavy crops of sugar, indigo, cereals, and food-stuffs, but through the interior runs a high, barren

ridge—the Bár—valueless except for pasturing here and there flocks of sheep. The climate is peculiarly hot and dusty, and the rainfall slight. Mohammedans form the majority of the population, the Jât tribes of the rural districts being very uncivilised. The British conquered the country in 1849 from Mulraj, a nominal vassal of Ranjit Singh. Multan, the capital and the only important city, stands four miles from the left bank of the Chenab, and was formerly traversed by the Ravi, which has now altered its course. It consists of one long bazaar and a mass of dirty, tortuous streets, partially enclosed within three walls, but large suburbs have sprung up within the last forty years. The trade of the place is considerable, and, as the headquarters of the district, it possesses political importance. Beyond two Mohammedan shrines and a ruined Hindu temple, there are no monuments of interest. It is connected by the Sind, Punjab and Delhi railway with the East Indian trunk line at Delhi and with the northern districts of the Punjab.

Multiple Proportions, LAW OF. [ATOMIC THEORY.]

Mumps (*Parotitis*), a contagious febrile malady, associated with inflammation affecting the salivary glands. Mumps is highly infectious, and is remarkable for the length of its period of incubation, which is rarely less than a fortnight, and may extend to three weeks. The onset of the disease is attended with headache and fever, accompanied by tenderness behind the angle of the lower jaw, in which situation swelling subsequently appears, caused by inflammation of the parotid gland. The parotids of both sides are usually involved; the submaxillary glands are generally also implicated. The swelling rarely lasts for more than a week and the disease almost always terminates in recovery. In rare instances, after an attack of mumps, inflammation affecting the testicle in the male and the breast in the female has supervened as a complication. Treatment as far as the patient is concerned consists mainly in confinement to bed, or at all events to one room, with maintenance of rest and quiet. The infectious nature of the malady demands that every precaution shall be taken to prevent the communication of the disease to others. In particular the patient must not resume his relations with the outside world until at least three weeks have elapsed after recovery.

Munchausen, BARON, the hero of the world-renowned adventures which have made his name a byword for mendacity, is believed to have really existed in the person of Hieronymus Karl Friedrich von Munchhausen, of Bodenswerder in Hanover, who died in 1797. He appears to have told his marvellous history to one Raspe. Raspe seems to have added many marvels borrowed from earlier impostors, and in 1786 published anonymously a small volume in London as the result of his labours. Several enlarged editions speedily followed, but their authorship remains unknown. In 1787 Bürger translated the book into German, and was for years regarded as the original writer, but in 1824 his publisher revealed the truth.

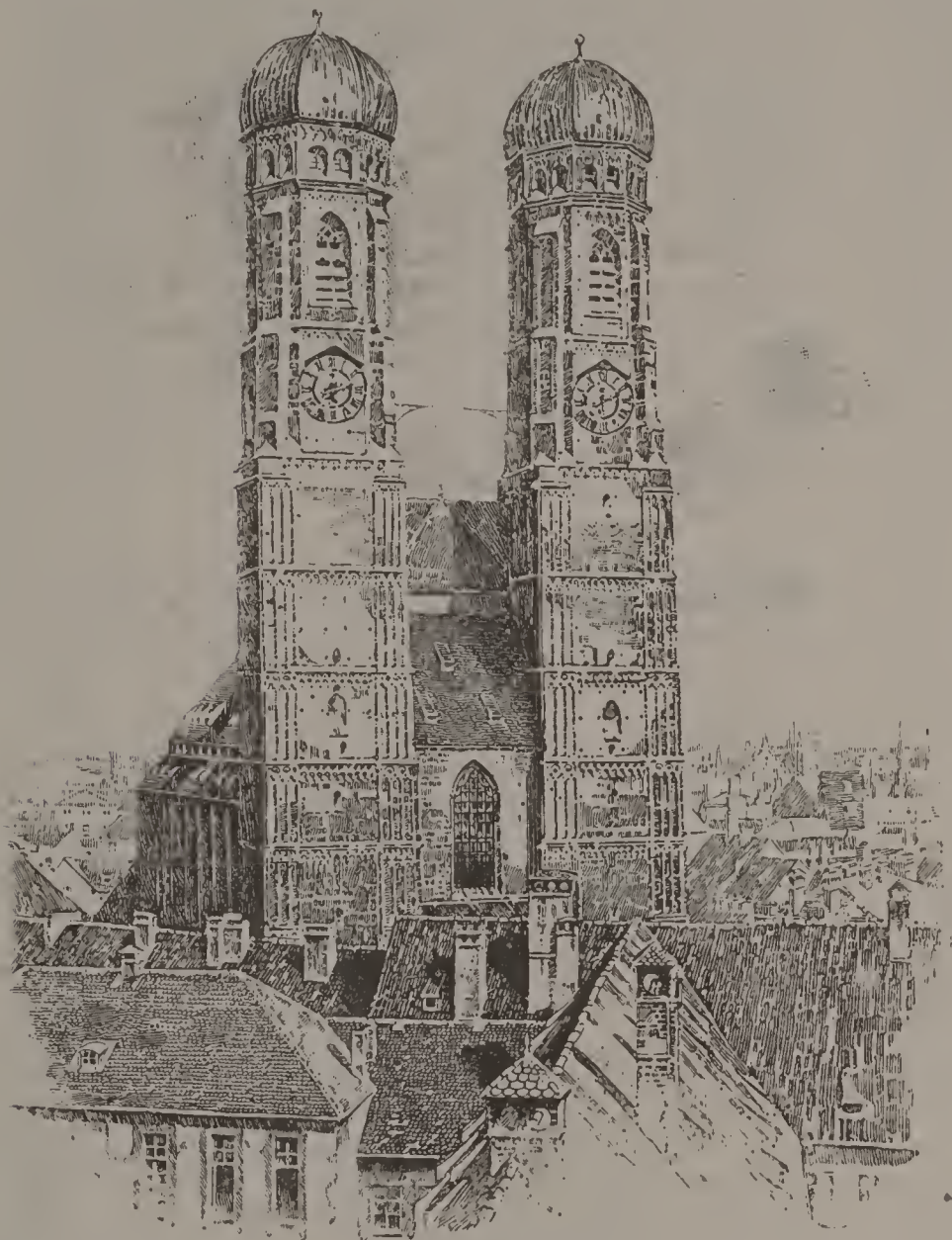
Munden, SIR JOHN. was born about 1655, and made a captain in the year of the Revolution. He took part in the battle of La Hogue in 1692, and in 1701 was promoted to be rear-admiral, and, upon conveying the king to Holland, was knighted. In the following year he was sent to intercept a French flotilla, and was, from no fault of his own,

the many squares and open spaces, are adorned with good specimens of statuary. In the ancient part of the town are several interesting churches, *e.g.* St. Peter's, the Frauen Kirche (the cathedral), St. Michael's, and the Theatiner Kirche, where the tombs of the Royal Family still exist. Parks and public gardens add to the attractions of the place, and the suburbs of Au, Haidhausen, and Ober-Giesing contain many handsome private dwellings. The collections of pictures, especially early German and Flemish examples, of engravings, drawings, statues, and antiquities, including the famous Æginetan marbles, constitute the chief glory of Munich, though the name is also associated throughout Germany with a particular kind of beer, consumed by the citizens at the rate of about 130 gallons per head annually. The death-rate reaches 30 per thousand. Furniture, musical and mathematical instruments, and works of art are produced.

Municipality, a town which enjoys certain rights of self-government, or the body in whom these rights are vested. The Roman *municipia* were under the government of two magistrates called *duumviri*, who corresponded to the consuls at Rome and were elected by the *curia* or *decuriones*, a body comprising a limited number of the inhabitants. Amidst the dissolution of the Roman Empire the *municipia* often succeeded in maintaining their privileges, and became models for the free cities of the Middle Ages. In countries, where few or no traces of Roman civilisation remained and institutions were derived mainly from Teutonic sources, the chartered town was simply a large village (*tun*) to which had been transferred the right of taxation, jurisdiction, and so forth, that had previously belonged to the lord of the manor or (on royal demesne) to the officers of the king. These duties involved an organised corporation, which was provided for in the charter. As life became more

complex, the scope of the functions exercised by the corporation or its officers was gradually enlarged. In England a self-governing town of this time was called a "borough," a term which has been somewhat vaguely used; it was long held to imply parliamentary representation, but since the Municipal Corporations Act (1835) a distinction has been made between "parliamentary boroughs" and "municipal boroughs," the latter including all municipalities with a reformed corporation or a corporation modelled on the lines of the Act. The corporation of a borough consists of a mayor, aldermen, and burgesses.

Munkacsy, MICHAEL, was born of poor parents at Munkacs, in Hungary, in 1846. In 1870 he exhibited *The Last Day of a Condemned Prisoner* in the Paris Salon, and his merit received immediate recognition. Among his best-known works are, *Milton dictating to his Daughters*,



MUNICH CATHEDRAL.

unsuccessful, and a court-martial fully acquitted him of blame. Yet popular ignorance and prejudice demanded a sacrifice, and the queen dismissed Sir John from her service. He died in 1718.

Munich (Germ. *München*), the capital of Bavaria and the fourth town for size in Germany, stands on a bare, lofty plateau, just N. of the Bavarian Alps, the river Isar skirting the eastern suburbs. The climate, therefore, is cold and unhealthy, but the central situation facilitates railway communication with all parts of the Continent. The old town, dating from the 12th century, has lost its walls and moat, but its gates and quaint old streets remain. The new quarters, originating chiefly with the impulse given by Ludwig I. (1835-68), present features of great beauty and interest. The Ludwigstrasse, in the Renaissance style, is one of the finest streets in the world, and other thoroughfares are of nearly equal beauty, and, like

Christ before Pilate, Calvary, The Last Moments of Mozart, most of which have been seen in England.

Munster, the largest of the four provinces of Ireland, embraces the S.W. portion of the island and contains the counties of Clare, Kerry, Limerick, Cork, Tipperary, and Waterford. The area is 6,064,579 acres, 29·1 per cent. of the whole country. Before Henry II.'s conquest there existed the kingdom of North Munster and that of South Munster, but these were subsequently merged into one province, and much of the best land, having been forfeited in Elizabeth's reign, was granted to English colonists who settled there.

Münster, the capital of Westphalia, North Germany, is situated on the banks of the Aa half-way between Bremen and Cologne. It grew up around the *monasterium* established by Charlemagne as the centre of the Saxon bishopric, and five hundred years later it became a prominent member of the Hanseatic League. Tendencies to Protestantism were sternly repressed by the bishops, who reached the height of their power in the 17th century, when Bishop Galen maintained an army of 20,000 men. The place suffered in the Thirty Years' War, which ended in the Peace of Münster (1648), and it was occupied by both parties in the Seven Years' War. The bishopric was annexed to Prussia in 1803. The town-hall dates from the 14th, the cathedral from the 13th, and the churches of St. Ludgerus and St. Maurice were founded in the 12th and 11th centuries respectively. The university was converted a hundred years ago into an academy, which holds a high educational status. Münster is a military and judicial centre for the whole of Westphalia, but it is no longer of much industrial importance.

Muntjac, any species of *Cervulus*, a genus of small Deer from the Oriental region. The males alone bear antlers, and their upper canines are tusk-like and curve downwards. From their alarm cry, muntjacs are called by sportsmen barking-deer.

Muntz Metal is an alloy of copper and zinc which contains more zinc than the ordinary variety of brass. It is also known as *yellow metal*, and is very largely employed for the sheathing of ships. It is usually prepared by melting the copper in a furnace and running it out into the molten zinc, the proportions being about three of copper to a little over two of zinc. A part of the zinc is, however, always lost by volatilisation.

Muong (MU'ONG LÁ), a large semi-independent nation of thirteen tribes occupying the neutral zone between Yunnan and Annam from the Mekhong to the Hong-Kiang ("Red River"), each under a separate chief, but all recognising a paramount lord, who resides at Shien-tien, and claims sovereignty over all the aborigines of Yunnan, Kwei-Cheu, and Kwang-si; they are a tall, strong, well-made race of a bronze colour, possessing a considerable degree of culture, good weavers and dyers, with some knowledge of letters and a peculiar syllabic alphabet of thirty-six characters. Since 1886 they have become French subjects.

Muræna, a large genus of brilliantly-coloured marine eels, the type of a family from tropical and sub-tropical seas; also any individual of the genus. [EEL.]

Mural Circle is a large metallic circle having a conical axis supported by a stone pier so that the circle is parallel to the face of the pier which is very nearly in the meridian. The instrument is adjusted so that the axis is accurately horizontal and the circle exactly in the plane of the meridian. The use of the instrument is to find the zenith distance of any star as it comes in the meridian. A telescope is firmly attached to the rim of the circle, its optical axis being parallel to the plane of the circle. The rim of the circle is accurately graduated from 0° to 360°, and six microscopes attached to the stone pier are directed straight on to the divisions. The use of six microscopes instead of one is to avoid error. A preliminary experiment determines the reading for the zenith, the circle is then turned so that the star, as it crosses the meridian, is bisected by the horizontal wire of the telescope. The reading for this is got from the microscopes, and the difference between this and that of the zenith gives the zenith distance of the star.

Murat, JOACHIM, was born in 1768, and educated for the priesthood. He abandoned that career at the first chance and enlisted in the cavalry. Elected member of the *Garde Constitutionnelle* imposed on the king in 1791, he speedily rose to the rank of major; but his advanced views led to his being recalled from active service, and in 1795 he made the acquaintance of Bonaparte, whom he assisted in supporting the Convention on the 13th Vendémiaire. He went with him to Italy and Egypt, where he won great distinction. On the 18th Brumaire, 1799, being then a general of division, he carried out the famous *coup d'état*, and Bonaparte gave him the hand of his sister Caroline. At Marengo he contributed to the victory, and became a Marshal of France, with the title of prince. More glory and further distinction were earned on the fields of Austerlitz, Jena, Eylau, and Friedland, until in 1808 he was entrusted with the conduct of affairs in Spain, and as a return for his services received the crown of Naples. He quarrelled with Bonaparte during the retreat from Moscow, and endeavoured to attach himself to Austria. Talleyrand upset this design, and Murat then proclaimed his intention of liberating Italy, and was expelled from his dominions. Bonaparte refused to accept his aid at Waterloo, and in 1815 he was shot at Pizzo.

Muratori, LUDOVICO ANTONIO, was born in 1672. He was trained in archæology by Bacchini, the Duke of Modena's librarian. Entering the priesthood, he obtained employment in the Ambrosian Library at Milan, where he published his *Anecdota* or extracts from historical manuscripts. In 1700 he succeeded his patron at Modena. His enemies accused him of heresy, but Pope Benedict XIV. extended to him his protection, and he retained his position, dying in 1750. Among his numerous works may be mentioned *Rerum*

Italicarum Scriptores, 500-1500 A.D., Novus Thesaurus Veterum Inscriptionum, Antiquitates Italie Medii Aevi, and Annali d'Italia.

Murchison, SIR RODERICK IMPEY, was born in 1792. Entering the army at the age of fifteen, he fought under Wellesley and Moore, taking part in the battle of Corunna. He left the service early. An accidental meeting with Sir Humphry Davy attracted his mind towards science, especially towards geology. In a few years he had explored large tracts of England and Scotland, and been elected joint-secretary of the Geological Society. In 1831 he began the investigations which led to the establishment of the Silurian system, the name given to the volume published in 1839. This was followed much later by a more comprehensive treatise, entitled *Siluria*. About 1840 he resolved to explore the rocks of Russia, and in 1845 published the results in his great work on *Russia and the Ural Mountains*. In 1846 he was knighted, and became President of the Royal Geographical Society. In 1866 he received a baronetcy, and subsequently founded the chair of geology at Edinburgh. He died in 1871.

Murcia, a province of Spain, with its capital. The former has a coast-line of 75 miles upon the Mediterranean, lying between Alicante to the E. and Almeria to the W., having an area of 4,478 square miles. With the exception of the plain of Cartagena and the sandy strip enclosing the Mar Menor lagoon, the surface is broken by spurs of the Sierra Nevada, reaching in places an elevation of 5,000 feet. These mountains are rich in lead, zinc, iron, copper, and sulphur, which are exported largely from Cartagena, the chief port. The valleys, especially along the course of the Segura and its tributaries, yield, under irrigation, good crops of oranges, olives, rough wine, and cereals, whilst the mulberry is extensively grown for silkworms, and the esparto grass on the marshy levels forms a valuable product. Besides the capital and Cartagena, Lorca is the only town of importance, but Aguilas and Mazarron have harbours and some trade. The city of Murcia stands on both sides of Segura in the midst of a very fertile valley, and is a handsome and well-built place with agreeable squares and gardens. The cathedral is in the late Gothic style with classical additions, and near it are the Bishop of Cartagena's palace and the colleges of San Fulgencio and San Isidoro. There is a good trade in silk and agricultural produce.

Murder. By the law of England, murder is the destruction of human life, accompanied with malice expressed or implied—i.e. an intention to kill or do great bodily harm or wilfully to place human life in peril, or resulting from an attempt to commit some other felony, or occurring in the course of resistance offered to ministers or officers of justice or others rightfully engaged in carrying the law into execution. [For cases of culpable homicide not amounting to murder see MANSLAUGHTER.] Express malice is signified by one person killing another with a deliberate mind and formed design, and which formed design is evidenced by external circumstances discovering such inward intention;

as by lying in wait, antecedent menaces, former grudges, and concerted schemes to do him or her some bodily harm. Implied malice is signified by one person's voluntarily killing another without any provocation; for when such deliberate acts are committed the law implies or presumes malice to have urged the party to the commission of them, although no particular enmity can be proved, as in case anyone trespassing in pursuit of game fires at a bird and, without any intention at all of doing so, hits and kills a man, that is murder, inasmuch as the act of poaching is felonious, and the felony therein couples itself to the death, and supplies the intention which was lacking. The punishment of murder by English law is death.

Murdock, WILLIAM, was born in 1754, and followed his father's trade as a millwright until 1777, when he entered the factory of Boulton and Watt at Birmingham, and was employed in fitting steam-engines at Redruth, Cornwall. Here, in 1792, he discovered the value of coal-gas as an illuminant, and, on his return to Birmingham as a partner, continued his experiments until, in 1802, the works at Soho were lighted by gas. Murdock invented many useful modifications of the steam-engine, and constructed a locomotive in 1784. He also directed his attention to the mechanical value of compressed air, and made a steam-gun. Retiring from business in 1830, he died in 1839.

Murger, HENRI, born in 1822 at Paris, was put as a boy into a lawyer's office, but soon wearied of the business. Count Tolstoy employed him for a time as secretary, but for ten years he seems to have led an obscure life of drudgery and dissipation. In 1848 he recorded his experiences in the *Vie de Bohême*, and the book by its candour and vigour at once became popular. *Claude et Marianne, Le Rendezvous, Le Pays Latin, Adeline Priotat, Les Buteurs d'Eau, and Le Sabot Rouge*, with a volume of verse, *Les Nuits d'Hiver*, came from his pen before 1859, when his health broke down, and he died in a private hospital two years later.

Muriatic Acid. [HYDROCHLORIC ACID.]

Murillo, BARTOLOMÉ ESTEBAN, the son of humble parents, was born at Seville in 1617. Whilst a child he showed such artistic tendencies that his distant relative, Juan del Castillo, took him into his studio. In 1642 he set out with the idea of visiting Italy and Flanders. At Madrid he fell in with Velasquez, the court painter, who set him to work at copying Ribera, Vandyck, and himself. Returning to Seville after two years, he undertook to adorn the walls of the small cloister of the Franciscan convent, and the eleven pictures which he then painted made his name. *The Flight into Egypt, the San Leandro and San Isidoro, the Nativity of the Virgin, and the Dream of the Roman Senator* illustrate this period. In 1658 he established the Academy of Seville, and in 1661 he began the pictures for the Hospital de la Caridad. Among his later achievements, which rather lack vigour, are the well-known *Assumption of the Virgin, St. Peter Weeping*, and a portrait of Canon Justino. He died in 1682.

Murrain, a term applied to any infectious disease occurring in cattle, particularly to what is known as foot-and-mouth disease.

Murray, EARL OF. [STUART, JAMES.]

Murray, SIR GEORGE, was born in 1759, and first went to sea in 1770. During the American War he served at the attack on Sullivan's Island in Charleston harbour in 1776, and in 1779 was taken prisoner of war. During the French War he was ordered to lead the van at the battle of St. Vincent, and later at the battle of Copenhagen. Upon the renewal of hostilities in 1803 he became captain of the fleet under Lord Nelson, whom he accompanied to the West Indies. Promotion to flag-rank and family troubles severed him from Nelson just before the battle of Trafalgar. He subsequently commanded the naval forces in South America and elsewhere, and, having in 1809 attained the rank of vice-admiral, died in 1819.

Murray, JOHN, the founder of the *Quarterly Review* and of the celebrated publishing-house in Albemarle Street, through whom Byron, Scott, Campbell, Moore, Southey, Crabbe, Heber, Hallam, and many other distinguished writers were introduced to the public, was born in 1778. He early succeeded his father, and, making the acquaintance of Canning, suggested in 1807 the establishment of the *Quarterly*, which did not, however, appear until 1809. In 1810 began his connection with Byron. Two years later he moved to Albemarle Street, where his house became the rendezvous of the best literary people. On his death in 1843 he left a son, JOHN MURRAY "THE SECOND," whose career, equally honourable if not equally brilliant, came to a close half a century after his father's death. The house still continues.

Murray, LINDLEY, was born in Pennsylvania in 1745. He was called to the bar, but on the outbreak of the War of Independence took to commerce, made a fortune, and ultimately came over to England, where he settled near York. Infirm health kept him almost a prisoner in his room, but did not prevent his composing several religious and educational works, among the latter being the *Grammar of the English Language*, on which his fame is based. He died in 1826.

Murray, SIR ROBERT, the first President of the Royal Society, was born about 1600, being the son of Sir Robert Murray of Craigie, Ayrshire. Entering the French army, he reached the rank of colonel, when the Civil War recalled him to Scotland, where he warmly supported the Royalist cause, and was appointed Lord Justice Clerk and Privy Councillor. During Cromwell's supremacy he again retired to France, and actively promoted intrigues in favour of Charles II. At the Restoration he was in high favour, and obtained the patronage of the king for the scientific club which was soon developed into the Royal Society. He died in 1673.

Murray River, THE, the largest of Australian rivers, is formed by the confluence of many streams in the Muniong Range of the Australian Alps. For some distance it flows W. to E., serving as the

boundary between New South Wales and Victoria, then passes into South Australia, and, taking a sharp bend to S., traverses Lake Alexandrina and discharges its waters into the ocean at Encounter Bay. During its course of 1,120 miles to the point where it debouches into the lake, it receives the Murrumbidgee, Darling, Goulburn, Lachlan, Compospe, and other tributaries, draining an area of 270,000 square miles. The upper portion is broken, uneven, and liable to semi-obliteration in dry seasons, but the lower reaches possess considerable breadth and depth, and are navigable from the lake to Albury, though, owing to the narrow and dangerous mouth, communication with the sea is hardly yet practicable.

Murshidabad, or MOORSHEDABAD, a district and its capital in Bengal, British India. The former has an area of 2,141 square miles, bounded by the Ganges from N. to S.E., by the Jalangi S., and by Birbhum and the Santal Pargannahs E. The Bagirathi cuts the district in two, the W. half, or Rahr, being barren for the most part and interspersed with *bils*, or marshes, whilst the Bagri, or E. portion, resembles the alluvial plains of the Ganges valley, and bears good crops of rice, wheat, pulse, and indigo. Mulberries, too, are grown for silkworms. Besides the capital, Barhampur, Kandi, Jangipur, Azimganj, and Dhulian are the chief towns. The city of Murshidabad, once the capital of Bengal, and still the residence of the titular Nawab Nizam, stands on the left bank of the Bagirathi. The trade is even now considerable, and the Jain bankers have extensive financial dealings. Few industries flourish, save ivory carving, metal-work, and embroidery, fostered by the native court, which has its headquarters in a fine palace on the river.

Musæus, a poet of Greece, of whom little is known, save that he flourished in the 5th century A.D. and left 340 graceful hexameters on the theme of *Hero and Leander*. A legendary seer of the same name existed in Attica five or six hundred years B.C., and is spoken of as the son of Orpheus and the introducer of the Eleusinian Mysteries.

Muscæ Volitantes are the specks which appear to float before the eyes, and which are due to small opacities in the refracting media. Unnoticed, as a rule, by those who have normal sight, they prove a source of considerable trouble in some short-sighted persons during periods of ill health. In rare cases their appearance is associated with some of the more serious affections of the interior of the eyeball.

Muscarine is a poisonous alkaloidal substance which occurs in fly agaric. It possesses the composition $C_5H_{15}NO_3$, and is closely allied to other poisonous and toxic substances, *e.g.* *choline*, *neurine*, etc.

Muscat, or MASKAT, the capital of Oman, Arabia, stands in a narrow inlet on the S. coast of the Gulf of Oman. The site is extremely hot and unhealthy, and the insanitary nature of the locality is increased by dirt and decay; but the convenience

of the harbour attracts a considerable trade, the exports being dates, fish, salt, cotton, pearls, and horses, whilst rice, coffee, sugar, and piece-goods are imported. The population is mainly Moham-medan, though a good many Hindus are among the traders. Owing to the long prevalence of the slave-trade, there is a large infusion, too, of African blood. It is an ancient place, but only rose into importance under the Portuguese (1508-1658). The present sultan owes his position to British influence. Much of the trade has been transferred of late to Matrah, a healthier suburb, just outside the bay.

Muschelkalk ("shelly limestone"), the German name for the middle member of the Trias (q.v.), as developed in Germany, France, and Poland. It is a grey or cream-coloured limestone, sometimes magnesian, with beds of rock-salt and gypsum, and numerous fossils, among which the most characteristic are the ammonitid *Ceratites nodosus* and the crinoid *Encrinurus liliaformis*, "the lily encrinite." The bivalve crustacean *Estheria minuta* and the pelecypod *Gervillia socialis* are also abundant. In France the series is known as *calcaire coquillier*. There are no similar beds in England.

Muscicapidæ. [FLY-CATCHER.]

Muscidæ, the largest family of Diptera, including most of the common species, and nearly half the known species, of the order. They are mostly small. The largest European species (*Echinomyia grossa*, Linn.) being only $\frac{3}{4}$ inch long. As a rule, their hues are dark, and not highly coloured; but some species, such as the Australian *Rutilia*, are of a brilliant metallic green. The familiar small house-fly (*Musca domestica*, Linn.) lays its eggs in dunghills; the adult often carries about one of the small parasitic chelifers, and it is also infested by the mould *Empusa muscarum*. Those attacked by the latter can often be found attached to windows by the fungus. The larvæ of most flies are parasitic on other insects—thus, *e.g.* that of *Echinomyia grossa* on butterflies, moths—but they attack other animals; thus, the *Sarcophagæ* are parasitic on worms, and the *Sarcophila* on mammals, including man. These lay their eggs in the ears or nose, and the larvæ eat their way into the flesh. The *Muscidæ* are divided into two main groups: the *M. calyptereæ*, in which the wings have a pair of lobe-like appendages (the alulæ) well developed; in the second division, the *M. acalyptereæ*, these structures are rudimentary or absent.

Muscle. The muscles are the contractile tissues of the animal body, and the power of altering their shape which they manifest is the means by which the various movements incidental to respiration, the circulation of the blood, etc., and the alterations of the position of the various parts of the skeleton with respect to other parts are brought about. There are three kinds of muscle. *Unstriated muscle* is also called involuntary muscle, as it is concerned in those movements which are not regulated by the will, *e.g.* contraction of the bladder, alterations in the calibre of blood-vessels, etc. Unstriated muscle is made up of spindle-shaped nucleated cells, which are grouped in

bundles, and these again may be aggregated together in the form of a membrane, such as occurs in the muscular coat of the bladder. *Heart muscle* is intermediate in character between the last-named variety and that which will be subsequently described; though it contracts apart from the influence of the will, it resembles to some extent the ordinary voluntary muscle; it possesses some degree of striation when seen under the microscope, but the fibres are branched; they possess no distinct limiting membrane, and the nucleus is situated in the body of the fibre. *Striated*, or ordinary *voluntary muscle* is made up of fibres which possess a limiting membrane, the *sarcolemma*, and immediately beneath this membrane, lying external to the main body of the fibre, there is found here and there a nucleus. When examined microscopically the fibres are seen to possess a distinct transverse striation, due to the muscle fibre possessing alternately arranged dim and bright bands; this appearance is more markedly developed in the muscles of certain invertebrates, particularly insects, than it is in man. Chemically, muscle consists of certain proteid substances, extractive bodies (kreatin, etc.), salts and water. The chief proteid of muscle is a body known as *myosinogen*. When a muscle is removed from the body it dies and undergoes what is known as *rigor mortis*—that is to say, it becomes stiff and rigid—this change being accompanied by the development of an acid reaction, and by the conversion of the myosinogen of the living muscle into myosin. This alteration of the muscle substance is closely analogous to the phenomenon of coagulation in blood, and myosin is nearly allied in composition to fibrin. The changes which occur when a muscle contracts have been attentively studied of recent years. It is found that heat is developed, sound is produced, certain changes in the microscopical appearance of the fibre occur, there is an evolution of carbonic acid gas, a taking-in of oxygen and the development of a body known as sarcolactic acid, and lastly there is an alteration in the electrical condition of the muscle, what is known as a *current of action* being developed.

Muses, in Greek mythology, were goddesses who inspired poets and protected art, letters, and science. They were nine in number—Calliope, the muse of epic poetry; Clio, of history; Melpomene, of tragedy; Thalia, of comedy; Euterpe, of lyric poetry; Erato, of erotic poetry; Polyhymnia, of the sacred hymns; Terpsichore, of choral song and dance; and Urania, of astronomy. They were usually represented as the daughters of Zeus and Mnemosyne. [MEMORY.] The chief seats of their worship were Mount Olympus in Thessaly, with the district of Pieria, which lies N. of it, and the neighbourhood of Thespiæ and Ascrea on Mount Helicon.

Mushroom, the cockney pronunciation of which "musheroon" more nearly represents its French original *mousseron*, is the name popularly applied, in contradistinction to that of "toadstool," to all edible forms of agaric (q.v.). It belongs

strictly to *Agaricus campestris*, a species growing, in short grass, on open breezy pastures grazed by cattle, in all temperate regions. It has a firm stalk, enlarged below and pithy, but not hollow in the centre; a cloth-like fixed ring (*annulus*) near the middle of the stalk, derived from the rupture of the veil (*velum*) of the "button-mushroom"; a firm, fleshy cap (*pileus*), not more than four or five inches across; numerous gills, free from the stalk, first flesh-pink and afterwards purple-black; and a dry, sometimes flocculent, and separable upper skin or cuticle. There are several varieties or closely allied species, as edible, if not as delicate. The horse-mushroom (*A. arvensis*), a larger, coarser species, growing in meadows or damp places, is largely brought to market. Perhaps the most dangerous allied form is *A. fastibilis*, with straight, almost ringless stalk, clammy surface, and brownish gills adherent to the stalk, which sometimes appears on mushroom-beds. Immense quantities of mushrooms are grown in underground caves near Paris, miles in extent, the fungi being gathered in a small immature condition. In England they are cultivated on a smaller scale, either in the open or in dark sheds. Mushrooms are indigestible in a raw state, and dangerous if at all decayed. Poisoning from mushrooms or toadstools is generally of a narcotic character, producing drowsiness and pains in the joints. Pending the arrival of medical assistance, sweet oil may be administered as a safe palliative and emetic.

Music is the art which aims at the realisation of an idea of beauty through the medium of pure sound. Unlike the so-called representative arts, it looks to nature for its medium only, not for its model. It offers nothing analogous to the criticism of life which has been regarded as the chief function of poetry, or to the truths of nature which find their most direct expression in painting; its criterion is wholly internal, and its validity depends not on its correspondence with any parallel in outward experience, but on its conformity with psychological laws. In its conception, as Schopenhauer says, "it is entirely independent of the phenomenal world, ignores it altogether, and could, to a certain extent, exist if there were no world at all." Hence, it is essentially a creative art in which the idea is presented to us, as it were, at first hand. Its chief requisite, therefore, is originality in the composer, whose thought, if it be not the genuine outcome of his own character, must necessarily be a plagiarism from his predecessors. The same event may be treated by different poets, or the same scene by different painters, all of whom can claim the first rank in virtue of their form; but in music thought and form are identical, and the interpretative side of art is wholly absent. Thus, in criticising the form of music, we are discussing not the embodiment of the art, but the art itself; and we may therefore classify its entire effect upon us under three heads, corresponding to the three psychological divisions of sense, emotion, and intellect.

(1) The sensation of sound is, on its material side, due to an affection of the auric nerve, under

stimulus of regular and periodic air-vibrations. By the rapidity of these vibrations is determined the *pitch* of the sound, that is, the distinction of high and low; by their size or volume the *degree* of the sound, that is, the distinction of loud and soft; and by their shape the *timbre* of the sound, that is, the particular voice or quality by which we distinguish the tones of different musical instruments. Again, a sound will be pleasurable or painful, according to the degree in which it stimulates the auditory organs; and, as these may, in different organisations, exhibit an almost infinite variety of sensitiveness, it follows that no dogmatic rule can be formulated as to what sounds are capable of giving pleasure or the reverse. This is particularly true of those composite vibrations which result from several notes combined in harmony. The terms "concord" and "discord" in musical science are restricted to a purely technical meaning, which explains their grammatical relations, but makes no more than a temporary allusion to their æsthetic effect. Chords which, at the present day, are regarded as specially pleasurable, have in past ages been condemned as intolerably harsh and dissonant; and we may therefore infer that the process of development which has brought about our own change of taste will continue to extend in future generations. If by discord we mean "that combination of sounds on which the ear is unable to rest with pleasure," it is obvious that the term must be relative to the qualities of the ear as well as to those of the air-vibrations by which it is affected.

(2) Through the senses music makes a further appeal to our emotional nature. Professor James has shown, in his *Principles of Psychology*, that our emotions are largely dependent on the physical conditions of the nervous system; and it is certain that, among the conditions mentioned, an important part is played by those which follow the sensation of sound. But music is not sufficiently definite to describe or evoke emotional states with any precision or exactitude. It can suggest general types of joy or sorrow, of quiescence or agitation, but it can no more specify their particular subdivisions than it can narrate actual events or depict actual scenes. Again, the receptivity of the emotional faculties must necessarily differ with different organisations, so that the same musical phrase which suggests terror to one may rouse merely a passing interest in another, and a phlegmatic hearer be left cold by an effect which stirs a more nervous temperament to a high pitch of excitability. Thus it is as impossible to criticise music in terms of emotion as in terms of sense. The criterion is too transitory in duration and too subjective in character to afford any certain basis for judgment; it is a statement of personal experience in the auditor rather than a scientific estimate of the composition.

(3) Thirdly, music appeals to the rational faculty in man, and it is by this appeal that its true validity as an art is determined. Truths of reason do not vary with various individuals, they hold good for all intelligences, and the ultimate characteristics of intelligence are the common inheritance of humanity. Thus, the claim of music to be regarded as something more than an "art of

pleasure" rests on its conformity with the laws of mind. The greatest composers—such as Bach, Beethoven, and Brahms—are greatest because, with a full command of sensuous and emotional effect, they have always regarded the intellectual laws as paramount; and similarly the permanent value of a composition will be found proportionate to the degree in which its intellectual laws have been observed; to those qualities of style and structure which exhibit the most satisfying perfection of balance and symmetry. It must be remembered that such an estimate is not mechanical, since in music imperfection of form means imperfection of thought; the two cannot be set in antithesis, for they are naturally indivisible.

Music, like everything else which admits of growth and progress, is in its highest development an organism, definite, coherent, and heterogeneous. By the first of these words we mean that a musical composition must be certain in its outline and clear in its structure, formed on a general plan as intelligible as that of a great poem or a great picture. By the second we mean that the different parts or factors, of which the structure consists, must be so arranged as to give an impression of unity in the whole; that there must be no otiose digressions and no "passages which lead to nothing." By the third we mean that these parts or factors must not present a monotonous similarity of character, but must supplement each other by adjustment of diverse shapes and diverse functions. A salient example may be found in Beethoven's Seventh Symphony, which displays these three qualities in a very high degree. It is a work of the greatest complexity, rich in surprises and contrasts, maintaining a full measure of variety and interest, yet its elements are so completely unified that it does not contain an unnecessary phrase or a superfluous modulation. Finally, it may be added that these principles of organic structure can be manifested no less in a simple melody than in an elaborate composition. The intellectual excellence of all music may be summed up as unity amid diversity.

Of Greek music we can ascertain but little, except that it consisted of unharmonised melody, or rather recitative, founded, during its best period, on certain diatonic groups of eight notes which were afterwards known as modes. These modes were systematised for church use by St. Ambrose and St. Gregory, from whose time to the end of the 16th century the chief development of music was due to ecclesiastical influence. There are two noticeable points of interest in this period: first, the growth of harmony, and more especially of counterpoint; secondly, the elaboration of the mass and the madrigal. The chief names are those of Dunstable, Dufay, Josquin, Orlando di Lasso, and Palestrina. The death of Palestrina in 1594 was a fatal blow to the established system, and in 1600 the Florentine revolution, under Peri, struck out a new direction by the invention of opera. The same year witnessed, in Rome, the first appearance of the "sacred music drama," which received afterwards the name of oratorio. These new types of composition, besides developing the dramatic and poetic side of music, did

much to advance melody and to fix the form of the modern scale. The work was carried on from different standpoints by Alessandro Scarlatti, Lulli, Purcell, Handel, and Gluck; while at the same time the fugue-form was brought by J. S. Bach to a pitch of perfection which it has never since surpassed. The improvements in musical instruments—especially the violin family and the pianoforte—prepared the way for a more artistic scheme of instrumental music, and the generation which followed Bach saw the development of the sonata, the quartet, and the symphony, materially aided by Haydn and Mozart, and culminating with Beethoven. At the beginning of the present century was inaugurated the romantic movement, the avowed object of which was to enlarge and extend the bounds of musical expression. Its chief adherents, Weber, Schubert, Schumann, Spohr, and Chopin, made few, if any, important contributions to the existing types of structure, but they did much to enrich the art on its emotional side. Mendelssohn, though related to the romantic school, cannot be accurately described as a member of it. The last epoch in the history of pure music has been the re-establishment of the ideals of Beethoven, which during the romantic movement had fallen into comparative disregard. This work of reconstruction has been almost entirely due to the genius of Brahms, to whom the next school of composition must necessarily look for its point of departure. Finally the reform of the opera, under Richard Wagner, has carried out to their logical conclusion the principles of Peri and Gluck, and has put upon the stage a form of music-drama in which all arts are laid under contribution for the furtherance of a dramatic idea. Wagner, however, is less a composer than a dramatist, and the discussion of his work lies at the extreme verge of musical study.

Musical Instruments. [See under various headings, VIOLIN, PIANOFORTE, etc.]

Musk-Deer (*Moschus moschiferus*), an aberrant Artiodactyle ruminant from the mountainous parts of Central Asia, constituting a subfamily of Cervidae (deer), or in some classifications a distinct family. The limbs are long, the ears large, the average height at the shoulder is twenty inches, the coloration greyish-brown, becoming paler in winter, and the long coarse hair is very brittle. They are generally met with singly in rocky places. Neither sex bears antlers; the upper canines of the male are abnormally large and curve downwards below the under-jaw. These animals are hunted for the musk of commerce, which is secreted by the males in a pouch in the abdomen.

Musk-Duck, a popular name for *Cairina moschata*, from Brazil and Paraguay, and *Biziura lobata*, from Australia, on account of the musky odour of the males. The former is often wrongly called the Muscovy Duck.

Musket, a smooth-bored, muzzle-loading small-arm, from which has slowly developed the modern rifle. The first British musket was the flint-lock that was famous as "Brown Bess." In Wellington's day it weighed 11 lbs. 4 oz., and was 4 feet 6 $\frac{3}{4}$

inches long without, and 6 feet long with, its bayonet. The powder charge was 164 grains; the bullet weighed 483 grains, and each man carried 60 rounds of ammunition and three flints. "Brown Bess" remained in the service till 1842, when the percussion musket followed. The only difference was the substitution of the percussion for the flint-lock, and the consequent reduction of the weight of the musket by 4 oz., although at the same time the weight of the bayonet was increased by 6 oz. [RIFLE.] Muskets of this pattern remained in use, except in rifle regiments, throughout the British army until 1851.

Muskhogeian, one of the stock races of North America, whose domain originally comprised nearly the whole of the present states of Georgia, Alabama, and Mississippi, with parts of Florida and west Tennessee, that is, most of the region between the Atlantic and the lower Mississippi river, and from the Gulf of Mexico to about lat. 36° N. The group takes its name from the Muskhogi (Maskoki), called Creeks by English writers, who were the chief tribe of the Creek confederacy. [CREEKS.] The other members of the family were the Chickasaws, Choctaws, and Seminoles, nearly all now at Union Agency, Indian Territory, with collective population over 16,000, besides the extinct or nearly extinct Alibamu, Apalachi, Koasati, Yamacraw and Yamasi. For the surviving nations see under the several entries.

Musk-Ox (*Oribos mosehatus*), an aberrant member of the Ox family, with affinities to the sheep, as its generic name denotes. It is about the size of the small Scotch cattle, with brown hair nearly a yard long and woolly under-fur (shed in summer). The horns are broad at the base and somewhat like those of the Cape Buffalo. Musk-oxen are found in small herds in the western hemisphere between 60° and 83° N. latitude. They feed on grass, moss, lichens, and the young shoots of the willow and pine. No special musk-gland is known to account for their musky odour.

Musk-Rat. [MUSK-SHREW, MUSQUASH.]

Musk-Shrew, a name for several shrews, from their musky odour. Those of Europe, also called DESMANS, constitute the genus *Myogale*, and are aquatic animals of rat-like form, with webbed feet and compressed scaly tail, which serves as a swimming organ. The snout is produced into a flexible proboscis, with which they probe the mud for their food—leeches, worms, and insect larvæ. The Pyrenean Desman (*M. Pyrenaica*), about eight inches long, with a tail as much more, has chestnut fur; the Common Desman (*M. mosehata*), from southern Russia, is much larger. Both are taken in large numbers for their skins, which are of commercial value. The Indian Musk-shrews belong to the genus *Crocidura*, and their musky secretion is so strong that it is commonly believed they can infect liquor with a musky taste by merely passing over the bottle. Musky wine and beer are certainly met with in India, but Jerdon thinks this is caused by these animals infecting the corks before they are used.

Muslin, a thin, fine, woven cotton fabric, the making of which originated at Mosul (whence its name), throve in the East Indies (where muslins of extraordinary tenuity and lightness are still woven, especially at Dacca), and was introduced into Scotland in 1780. The manufacture of muslin is now an important industry in Great Britain and France. Muslins may be plain, figured, embroidered, colour-woven or printed.

Musquash (*Fiber zibethicus*), a large vole-like aquatic rodent ranging from Rio Grande to the Arctic regions. The head and body are about a foot long, and the scaly tail nearly as much more. The fur—to obtain which large numbers are taken yearly—is umber-brown above, and grey below. In summer they burrow in the banks, and in winter build dome-like dwellings of sedge and grass plastered with mud. They swim and dive well, and feed on aquatic vegetation. Musk glands are present in both sexes.

Musset, ALFRED DE, was born in 1810. He early translated De Quincey's *Opium-Eater*, and contributed verses to provincial papers in 1830. In 1833 he joined the staff of the *Revue des Deux Mondes*, publishing in its pages *André del Sarto*, *Les Caprices de Marianne*, and *Rolla*. His intimacy with Georges Sand followed, and resulted in their Italian tour with the quarrel that ended their *liaison*. In 1835 appeared *Lucie*, *La Nuit de Mai*, *La Nuit de Décembre*, and other poetic effusions, with *Les Confessions d'un Enfant du Siècle*. In 1850 he collected his poems into a volume, which placed his reputation on so firm a basis that he was elected two years later to the Academy. He died in 1857.

Mustang. [HORSE.]

Mustard, the sub-genus *Sinapis* of the cruciferous genus *Brassica* (q.v.), distinguished by its spreading sepals. It includes several British species, among which are *B. nigra*, the black mustard, and *B. alba*, the white mustard, differing, among other characters, in the colour of their seeds. The seedling plants of *B. alba* are eaten with cress as a salad. It is cultivated in Essex and Cambridgeshire, as is *B. nigra* in Lincolnshire and Yorkshire, for its seeds. The pungency and odour of mustard are due to the action of an albuminoid ferment *myrosin*, present in both species, in the presence of water upon other principles which they contain. These are *sinigrin* (C₁₀H₁₈KNS₂O₁₀) in black mustard, and *sinalbin* (C₃₀H₄₄N₂S₂O₁₆) in white. In the former case the volatile essential oil of mustard is developed; but in the latter another non-volatile but equally rube-facient compound. The use of mustard, both as a condiment and in medicine, dates at least from the time of Hippocrates. The seeds are now crushed, and the flour is sifted from the husk. It is very commonly adulterated with flour, turmeric being added to preserve its yellow colour. The seed of the Indian species, *B. juncea*, is now largely imported. The export from India in 1888 was 2,125 tons. The oil expressed from this species, known

as *mustard-seed oil*, is employed in India in cooking and for lamps.

Mustard Oils. The volatile oil obtained from mustard seeds consists chiefly of a compound known as *allyl isosulphocyanide*, $C_3H_5 \cdot CNS$. The name, however, was extended to the whole class of compounds which contain the group $\cdot CNS$, and which closely resemble ordinary mustard oil in their generic properties. This compound is a liquid which boils at $151^\circ C.$, possesses a disagreeable smell, and blisters the skin. It has acquired additional interest of late years owing to its producing the phenomenon known in photography as *reversal*. [PHOTOGRAPHY.]

Mustelidæ, a family of Bear-like Carnivora, with three sub-families, of which the types are the Badger, Otter, and Weasel (all which see).

Mute, (1) a clip or weight of brass, hard wood, or ivory used to modify the tone of the violin and other stringed instruments by slipping it over the bridge; (2) a pear-shaped leather pad, placed in the bell of a wind-instrument to deaden the sound.

Mutiny, in a naval or military sense, active disobedience to, or revolt against, authority, or the use by persons in the naval or military service of traitorous or disrespectful words against the sovereign or members of the royal family. The punishments for various mutinous acts are prescribed in the articles of war. Mutiny, in a more general sense, means unlawful resistance to any constituted authority, especially at sea.

Mutiny Act. [ARMY.]

Muttra, a district and its capital in the North-West Provinces of British India. The former occupies an area of 1,453 square miles along the banks of the Jumna, being bounded by Agra S., Aligarh and Gurgaon N., Bhartpur W., and Manipuri and Etah E. The surface, except in the S.W., is uniformly level. The agricultural products are scanty, although the soil towards the E. is remarkably rich, but enough is grown in the way of cereals, pulse, and cotton to keep the population, almost entirely Hindu, in fair prosperity. The climate is liable to great extremes, and the Jumna, sometimes an expanse of mud, sometimes a widespread flood, adds to the general unhealthiness. The central portion of the district is one of the most sacred spots in India as being the home of Krishna, the favourite Hindu god, and Balarama, his brother. Here, too, Buddhism took its rise. The city of Muttra stands on the right bank of the Jumna, 30 miles above Agra. Its antiquity must be considerable, and even in 400 A.D. it was an important Buddhist centre. For this reason the Mohammedan conquerors more than once laid a heavy hand on the place, and destroyed many temples and monasteries, but it is still the goal of thousands of pilgrims. The British cantonments lie outside the city.

Muyscas. [CHIBCHAS.]

Mya, a genus of bivalve shells containing *M. arenaria* and related species. *M. arenaria* is the common clam of most parts of America.

Mycelium, the vegetative part of a fungus, serving the same physiological purposes as roots in attaching the plant to its substratum and in taking in nutriment. Its typical form is that of branching filaments (*hyphæ*), with or without transverse partitions, sometimes in parasitic forms, putting out minute sucker-like branches (*haustoria*) which penetrate the cells of living host-plants. Resting reserve-stores resembling tubers, and known as *sclerotia*, with thickened external walls, occur on some mycelia, as in ergot (q.v.). In other cases, such as *Agaricus melleus*, thick mycelial strands, or "sclerotia with growing points" are formed, which are known as *Rhizomorpha*, and in this particular species ramify beneath the bark of the pine tree, the mushroom-like fructification being perhaps several feet distant from the tree. Another dense mycelial structure, known as *mycorrhiza*, occurs in the truffle *Elaphomyces*, and other fungi, round the roots of various trees, including conifers and Cupuliferæ. This mycorrhiza prevents the formation by the tree of its normal root-hairs, and is believed by Frank to be in a condition of symbiosis (q.v.) with the tree, performing for it the function of absorption otherwise carried on by root-hairs. In the cultivation of the mushroom the mycelium is popularly termed "spawn."

Mycenæ, a most ancient city of Greece, said to have been founded by Perseus on a crag to the N.E. of Argolis, in the Peloponnesus, was in the Homeric period the capital of that country and the home of Agamemnon. The existing remains, fully explored by Schliemann and Tsoundas, reveal interesting traces of Cyclopean and Achaian architecture, such as the Gate of Lions and the Treasury of Atreus. Vases, weapons, personal ornaments of gold, death-masks, and other relics of primitive civilisation have been found by the excavators, most of them showing a closer affinity to Oriental than to Greek art. The city was destroyed by the Argives as early as 468 B.C., and has never since been inhabited.

Myelitis, inflammation of the spinal marrow (Greek *myelos*, "marrow"), is a disease which sometimes results from exposure to cold, and may supervene upon caries of the vertebræ, the spinal cord from its position in the spinal canal being particularly liable to involvement in cases of vertebral disease. The symptoms vary according to the part of the spinal cord which is affected. Both sensation and power of movement are, as a rule, implicated, and these symptoms are generally especially manifested in the lower limbs, producing *paraplegia* (q.v.), though the arms may be also attacked; when one side of the spinal cord is especially involved, the symptoms are particularly developed on one side of the body. Pain is not usually a marked symptom; there is rather loss of sensibility as a rule; there may be, however, a feeling of constriction as of a band drawn tightly round the body in the situation corresponding to the superior limit of the portion of spinal cord which is affected. Bed-sores are apt to develop, and trouble in connection with the bladder not infrequently arises. Acute myelitis is a serious disease, which frequently terminates fatally. In the milder form of the malady

recovery may occur, but some degree of paralysis is usually left behind.

Myna, MYNAH, any bird of the Indian genus *Acridotheres* of the Starling family. The bill is short, strong, and slightly rounded at the ridge; the powerful feet have strong toes; the tail is round, and the head more or less crested. *A. tristis*, the Common Myna, is about 10 inches long, with black and brown plumage, with some white on the wings, tail, and under-surface. These birds feed on insects, fruit, and grain, and prefer the neighbourhood of towns and villages to wooded places. They are frequently kept as pets, and are said to excel parrots in imitating the human voice. The same has been said of birds of the allied genus *Gracula* (Linn.), in which the head bears yellow wattles behind the ears. They also are called Mynas. *G. religiosa* is fairly common as a cage-bird in Britain.

Myngo, SIR CHRISTOPHER, served as a captain during the first Dutch War, and was vice-admiral of the White in the action of June 3rd, 1665. During the height of the battle of June 4th, 1666, he was killed. His son CHRISTOPHER took part in the battle of Malaga, became superintendent at Portsmouth 1708, retired 1714, and died 1725.

Myopia. [EYE. (*Errors of Refraction*.)]

Myosin, a proteid substance which occurs in muscle, from which it may be extracted by water and afterwards precipitated by salt. In most of its chemical characters it closely resembles ordinary blood fibrin. It appears to exist in muscle in a dissolved state, and to its coagulation appears to be partly due the phenomenon of *rigor mortis* or *death-stiffening*.

Myriapoda, a class of animals belonging to the phylum Arthropoda (q.v.). The members of this group each consist of a head followed by a considerable number of somites, or segments, which are all similar to one another. Each of these has one or two pairs of jointed legs, the former being the case in the centipedes, and the latter in the millepedes. The head is armed with three pairs of appendages: the antennæ or feelers, and two pairs of jaws, known as mandibles and maxillæ. The myriapods all live on land, and breathe by air-tubes or "tracheæ" running throughout the body. The millepedes are vegetarian, and the centipedes carnivorous. The class is divided into two orders, the Diplopoda or Chilognatha, including the millepedes (q.v.), and the Chilopoda or centipedes (q.v.). The remarkable genus *Peripatus* was once included here, but is now relegated to a separate class, the Protracheata (q.v.).

Myrmecophaga. [ANT-EATER.]

Myrmeleontidæ, a family of insects belonging to the class Neuroptera (q.v.), and which includes the "Ant-lions."

Myrobalans, the astringent drupaceous fruits of various species of *Terminalia* and *Emblia*, imported from India for tanning and calico-printing. *Terminalia* is a genus of trees belonging to the calycifloral order Combretaceæ, the chief

species employed being *T. Chebula*, the Chebulic, *T. citrina*, the Citrine, and *T. Bellerica*, the Bedda nut, Belleric or bastard myrobalans. The immature or unripe fruits are known as black myrobalans. *Emblia officinalis*, the source of Emblic myrobalans, is an entirely distinct plant, being a large tree, the only species of a genus of Euphorbiaceæ. In India its bark is also used in tanning. Myrobalans yield permanent black and yellow dyes, valuable to the calico-printer. India now exports 8,000 or 9,000 tons of myrobalans annually, mostly to England.

Myronic Acid is a member of the group of compounds known as *glucosides* (q.v.), and exists, combined with potash, in the seeds of black mustard. It forms silky needles which, by boiling with baryta, or under the influence of a special ferment (*myrosin*) also present in the seeds, decomposes into mustard oil, acid potassium sulphate, and glucose, according to the equation



Myrrh, a fragrant gum-resin, the produce of several species of *Balsamodendron*, a genus of the order Terebinthaceæ, natives of Somali-land and south-west Arabia. The chief species seem to be *B. Myrrha*, *B. Opobalsamum*, and *B. Kafal*, small spinous shrubs. Myrrh is collected in Somali-land, and round Harar, brought to Berbera, and shipped thence to Aden and Bombay; but the Somalis also cross over and collect myrrh on the hills east of Aden. It exudes from the cracks in the trunk near the root. All myrrh now comes from Aden or Bombay, the names, Turkey or African, Arabian, Siam, or Persian, only indicating quality. We import from 400 to 600 chests annually, each containing from one to two cwt. Myrrh occurs in irregular sub-translucent, reddish-yellow or reddish-brown tears, aromatic and bitter. It contains a gum soluble in water, a resin sometimes amounting to 27 per cent., and a heavy volatile oil, sometimes 3 per cent. It was used by the ancients as incense, as an unguent and a perfume and in embalming. The offering of myrrh, with gold and frankincense, by the sovereign in the Chapel Royal on the Feast of the Epiphany, in commemoration of that of the Magi to our Lord, dates at least from the time of Edward I. In medicine myrrh is chiefly used with aloes and iron. It seems to act specially on the mucous membrane, increasing appetite and facilitating digestion.

Myrtle (*Myrtus communis*), a native of western Asia, naturalised in the Mediterranean region, is the only representative in Europe of the considerable and widespread genus which gives its name to the large calycifloral order Myrtaceæ, an order which includes the gum-trees (*Eucalyptus*), the Clove (*Eugenia*), and the Brazil-nut (*Bertholletia*). The myrtle is a low-growing shrub, with evergreen, opposite, simple, dark-green leaves, studded with translucent glands containing a fragrant essential oil, and having well-marked infra-marginal veins. The white, sweet-scented flowers are on short axillary stalks, have an inferior ovary, five sepals, five petals, indefinite stamens, and a long slender

style. The fruit is a purplish berry. The myrtle is fairly hardy in the south of England. By the ancients it was held sacred to Venus, and myrtle wreaths were worn by the victors in the Olympian games and by the Athenian magistracy. A fragrant astringent extract, known as *eau d'ange*, is now distilled from the flowers, and the leaves are used in sachet-powders, and other perfumery.

Mysore, or MAISUR (*Mahesh-Asura* = "Buffalo demon"), a native state in southern India, entirely surrounded by British territory, extends over 24,723 square miles, occupying a lofty plateau 2,000 feet above the sea-level, with a slope towards the Bay of Bengal, into which the Cauvery, Tungabhadra, Krishna, Pennair, Penar, Hugri, and Palar rivers discharge themselves. The area is divisible into two distinct parts, the hill-country, or Malnad, marked by isolated rocks (*durg*) that attain a height of over 4,000 feet, such as Nandidurg, Savandurg, etc. on which strong fortresses were often built, and the plain, or Maidan, an undulating expanse thickly populated and well cultivated. The climate, owing to the elevation, is mild and healthy, and the soil yields all the products of India with many of the temperate zone, such as apples, peaches, and strawberries. Drought is the one serious drawback, and to guard against it 20,000 tanks or lakes have been made in various parts, yet in spite of this famine not seldom prevails. Gold-mining has recently been revived, but the manufacture of rugs and carpets, the smelting of iron, and the production of jewellery are the chief industries. MYSORE, the ancient capital, stands in a valley at the foot of the Chamandi Hill ten miles S.W. of Seringapatam. It consists of fairly well-built and spacious streets covering some three square miles, and at the S. is erected the vast quadrangular fortress, enclosing the palace of the Maharajah, who, however, now resides chiefly at Bangalore, the administrative centre of the state. In the E. suburbs are the British residency and the European quarter.

Mysteries, in the religion of ancient Greece, were ceremonies of an exceptionally sacred character, participation in which was preceded by a course of special preparation called initiation. The initiated were not permitted to divulge what they saw and heard, so that any information concerning the mysteries is, for the most part, derived from Christian writers. It is probable that—at least in their full development and highest form—they represent a struggle after a deeper and more satisfying form of belief than any afforded by the popular religion of Greece. The *mystes* looked forward to a future life because he believed that the divine knowledge communicated at Eleusis had placed him outside and above the conditions of material existence. And this higher knowledge was not the privilege of a few favoured individuals; the mysteries were open to all who would submit to the severe and tedious process of initiation. The most celebrated mysteries were the Eleusinian, in which the worship of Demeter and Persephone (Cora) became associated with that of Dionysus. The stories of Demeter and

Persephone were originally nature-myths, explaining the vicissitudes of the seasons; but in the Eleusinian worship the primary meaning appears to have been lost sight of, and perhaps the secret lore and ineffable rites alluded to in the Hymn to Demeter, the *hieros logos* of Eleusis, embodied some new interpretation of the divine tale. The Eleusinian mysteries were celebrated on 22nd and 23rd Boëdromion (September). They included the dramatic representation of incidents in the lives of the deities worshipped, the exhibition of relics connected with their history, the delivery of oracular utterances and the chanting of traditional songs. During the solemn procession from Athens which preceded these ceremonies the enthusiasm of the worshippers was raised to the highest pitch by means of constant worship at shrines along the way; and the awe-inspiring character of the subsequent ritual resulted in a state of tension and excitement very foreign to the ordinary character of Greek worship. The Orphic mysteries, though closely allied to the Eleusinian, soon passed into the hands of an inferior class of mendicant priests (like those of whose methods we have some account in Demosthenes' *De Corona*) and are condemned by Plato as demoralising in their tendencies. During the decay of Greek civilisation the Neo-Platonists exercised their ingenuity in inventing recondite meanings for the symbolic observances. In the last stage of their existence even the better class of mysteries had degenerated into licentious orgies.

Mysteries, or MIRACLE-PLAYS, mediæval religious dramas. Not to be confused with the word as used in the preceding article. Strictly, the word should be spelt *mystery*, as it is derived from the Latin *ministerium*, a craft, or occupation, and was applied to those plays which were performed by the guilds. They were acted by lay associations, especially the craft guilds in their halls. We possess three collections of English plays of this type: the Towneley plays, believed to have been acted at the fairs of Woodkirk, near Wakefield, in the 13th or 14th century; the Chester plays, dating from about 1400, and Coventry plays, which, for the most part, belong to the 15th and 16th centuries. All these are what are called "collective mysteries"—i.e. each consists of a group of plays which, taken together, constitute a complete cycle of Bible history. In 1264—a date probably earlier than the composition of any of these plays—Pope Urban IV. endeavoured to restore the sacred character of the mysteries and miracles by making them an integral part of the Corpus Christi festival, which was then instituted, but his efforts met with little success. It remains to mention a form of dramatic entertainment which may have had some share in shaping the destinies of the miracle, though its influence was probably not very great. This was the literary monastic drama, which grew up in imitation of the "comedies" of Hroswitha (circa 920–68), a nun of Gandersheim, in Saxony. Plays of this class were sometimes acted by the children of a convent or monastery school; such,

for example, was the play of *St. Catherine* performed at Dnnstable in 1110. Amongst the various countries of Europe, in each of which the growth of the drama took a somewhat different course, France requires special mention, on account of the secular characteristics which were maintained through the influence of the *jongleurs* and *menestrels*, who corresponded to the Roman *mimi*. In France, theatrical performances were mostly in the hands of three great lay fraternities: the Bazoche (founded 1303), the Confrérie de la Passion, and the Enfants sans Souci, whose *sotties* and *farces* were in many respects an anticipation of the regular drama. Such plays as *Griseidis* (1395) and *Maistre Pierre Patelin* (1480) supply important landmarks in the development of dramatic art. Throughout western Europe the modern drama was developed from the miracle through the *moralité*, in which allegorical personages representing certain virtues and vices took the place of the characters from Scripture or sacred history; their popularity was ensured by the ludicrous behaviour of such characters as the Devil and his attendant, the Vice. Afterwards historical, and then purely fictitious, characters were introduced side by side with the symbolical figures. John Heywood (d. *circa* 1580) was the first dramatist in England who set the latter entirely aside; but though the advance through the preliminary stages was so much more rapid in France, it was in England alone that the romantic drama was destined to reach its full development.

Mysticism, a form of religious life which consists in an effort to rise above the sphere of finitude, imperfection, and error, and enter into direct communion with the Divine Being. It is often confused with doctrines and tendencies which are utterly foreign and even hostile to its ultimate purpose, such as theosophy and symbolism; the reason is that these things, although not of the essence of mysticism, frequently are conjoined with it. Mysticism is a most important and stable element in most Eastern religions; amongst the various Oriental types Sufism is perhaps the most remarkable and interesting. In the West, mysticism has had to contend with the practical bent inherited from Roman civilisation, which received a fresh impetus from the immigration of the northern races; and here it has had a more varied history, blossoming with renewed vigour, often as a reaction against scepticism or rationalising, under a peaceful ecclesiastical organisation, or in times of political upheaval when the individual was forced back upon himself, and withering in the uncongenial atmosphere of social activity and material progress. To Neo-Platonism, itself strongly impregnated with Oriental modes of thought, is due directly or through circuitous channels the mysticism both of Catholic and Protestant Europe. The works of Dionysius the Areopagite are the link connecting the Neo-Platonists with the mediæval mystics. Mediæval mysticism, as handled by such men as St. Bernard of Clairvaux, Hugo of St. Victor, Bonaventura, and Thomas à Kempis, may be regarded as the complement of scholasticism, supplying the devotional element, with its corresponding theory,

whilst the schoolmen worked out a system of rational theology on the basis of Church dogma. On the other hand, the German mysticism of the 14th and 15th centuries was a distinct effort to break away from ecclesiastical tradition; the aim of Meister Eckhart (1260–1329) and his followers was not so much to accommodate mysticism to Church doctrine as to reconcile this with their own Pantheistic views. To the school of Eckhart belonged Suso (1295–1366), Tauler (1300–61), in whom mysticism took a curiously practical bent, Ruysbroeck (1293–1381), and the anonymous author of the *Deutsche Theologie*, which exercised a powerful influence over the mind of Luther. Since the Reformation, mysticism has appeared amongst men professing every shade of religious belief, in a variety of forms which it is impossible to reduce to any common principle. That which has arisen within the Roman Church—represented by St. Theresa (1515–82), St. John of the Cross, and the Spanish and French Quietists—has been marked by a complete absence of speculative tendencies, combined with a genuine spirit of devotion and a somewhat over-imaginative fervour. The mystical theories of Jacob Boehme (1575–1624), the extraordinary shoemaker of Görlitz, have influenced thinkers of the highest capacity, such as Schelling, Hegel, and Coleridge. The so-called Cambridge Platonists are reckoned among the mystics, and William Law (1686–1761) was a disciple of Boehme; but in England mysticism has seldom found a congenial soil. [Schools and sects alluded to here are discussed in separate articles.]

Mythology, the science which deals with myths. Tylor defines myth as “sham history, the fictitious narrative of events that never happened.” His books (*Primitive Culture* and *Early History of Mankind*) are invaluable to the student, for they contain myths from all parts of the globe, with exact references to the authorities whence they are taken, and where further information may be found. When the term “mythology” first came into use, it was applied to the stories told about the gods of ancient Greece and Rome, then extended to those of all Aryan peoples, and is now employed for myths in general; for it has been found that nearly all the classic myths have their counterparts among races of low culture at the present day. Mr. Andrew Lang, one of the greatest authorities on the subject, arranges myths under the following heads:—(1) *Divine Myths*, dealing with the origin of the gods and heroes. (2) *Cosmogonic Myths* dealing with the origin of the universe and of this earth in particular. (3) *Myths of the Origin of Man*. Some of these are based on the idea of creation; others on that of evolution. (4) *Myths of the Arts*, such as the invention of letters by Cadmus. (5) *Myths of the Stars*, which are commemorated in the names of the constellations. (6) *Myths of the Sun and Moon*, with their relationship to each other. (7) *Myths of the Origin of Fire*. With the subject-matter thus arranged, one may go on to acquaintance with the myths themselves. Those of the Aryan nations may well be taken first, special attention being paid to those of Greece and Rome, for which the best

authorities will be the classic poets. In studying myths of other peoples their sacred writings (if any such exist) should be reverently examined, and carefully compared with other scriptures. The problem of mythology is to account for the extraordinary stories told about the gods, and the search for the solution is full of interest. The idea of revelation is precluded by the nature of some of these stories, which could not possibly have originated with the Greeks of historic times, for at a very early date some explanation of them was felt to be necessary, though no satisfactory one could be found. But if one imagines primitive man occupied with the questions of the origin and destiny of the race, and considers his tendency to attribute powers similar to his own to brute beasts, and life and intelligence to the powers of Nature, there will be no surprise at gods having the shape of men and beasts and the morals of the lowest savages. Thus, the morality of a myth may be taken as some criterion of its age. One may be pretty sure, apart from any evidence, that the stories of the intrigues of Zeus with women are older than the charming myth of Baucis and Philemon. This method of studying mythology will probably lead to the conclusion that, though religions be many, Religion is one, and may show its development where some people would least expect to find it (*cf.* Genesis xxii. 1, 2 with Isaiah i. 10-20).

Myxœdema, a disease, the characteristic symptom of which is the development of a peculiar œdematous thickening of the subcutaneous tissue, which is said to be the deposit in the connective tissue lying beneath the skin of a mucous substance. The œdema is most marked, as a rule, in the face and hands, the lips are thick, the eyelids swollen, and the expression of the features materially altered, the skin is dry and has a waxy appearance. The fingers become thickened, and the hands assume what is known as the "spade-like" appearance. Certain symptoms are, as a rule, associated with the development of the subcutaneous thickening, the chief of which are slowness of speech, feeble gait, and deafness. The malady is said to be due to a loss of the normal activity of the thyroid gland, and in many cases it is certain that this gland undergoes atrophy. The method of treatment which has been employed of late years and which consists in administering the extract of the thyroid of the sheep either subcutaneously or by the mouth, has been attended with very beneficial results.

Myxomycetes, an obscure group of organisms referred by De Bary, to whom we owe most of our knowledge concerning them, to the animal kingdom, under the name *Mycetozoa*, he considering their nearest relationship to be with *Amœba* (q.v.). Other botanists, however, emphasise their resemblances to *Fungi* (q.v.). Their vegetative body, unlike any fungoid thallus, is a naked irregular mass of protoplasm known as a *plasmodium*, which is formed by the coalescence of ciliated zoospores. These zoospores, like the plasmodium, are irregular in form, and possess the power of putting out finger-like processes or *pseudopodia*, moving by a

crawling or "amœboid" movement. The plasmodium nourishes itself saprophytically, these organisms living always in damp situations, such as tan-pits or decaying autumn leaves; and it may attain, as in *Puligo varians*, the "flowers of tan," a length and breadth of several inches. It is granular, with many nuclei and foreign bodies, but has a clearer margin and sometimes apparently a non-protoplasmic envelope. The reproductive structures, or spores, are generally formed in sporangia, which arise as swellings on the plasmodium drawing up its protoplasm into their interior. When mature this interior is either filled with spores, or contains also a network of filaments (*capillitium*), which is seemingly connected with the bursting of the sporangium. The spores resemble those of fungi, having a wall and nuclei and retaining their germinating power for years. Germination consists in the bursting of the spore and the escape of a naked, and at first unciliated, zoospore, which, as we have seen, coalesces with others to form a plasmodium. This coalescence has been termed *multiple conjugation* and considered as a sexual act. In addition to the "flowers of tan," one of the best-known Myxomycetes is the "finger-and-toe disease" of the turnip and other Cruciferæ, *Plasmodiophora brassicæ*.

N

N, the fourteenth letter of the alphabet, corresponding to the Phœnician *nun* ("fish"), was derived from the hieroglyphic sign for water. It is the nasal dental, holding the same relation to *d* and *t*, that *m* does to *b* and *p*. Hence *d* was often generated after *n*, as in *thunder* (Anglo-Saxon *thunor*). The "parasitic" letter which thus arose through careless pronunciation belonged to the palatal class if a palatal letter followed, to the guttural if it came before a guttural (*e.g.* *sing-ging* for *sin-ging*). In some words the *n* itself is parasitic, *e.g.* *messenger* for *messager*. *M* and *n* interchange before labials and dentals, *e.g.* *comfort* from Latin *confortare*; *count* from Latin *comitem*.

Nabob, in the period of the Mogul empire, was a deputy provincial governor, acting under a *soubah*, or viceroy. In the early days of our Indian empire the title was given in a spirit of ridicule to the officers of the East India Company and others who, after making large fortunes abroad, returned to lavish their money in England, especially in the purchase of pocket-boroughs.

Nachtigal, GUSTAV (1834-85), a German traveller, was born at Eichstadt. Having studied medicine, he received an appointment as army surgeon. In 1863 he took advantage of a visit to North Africa in search of health, to observe the country and people, and in 1868 was chosen as the bearer of presents from the King of Prussia to the Sultan of Bornu. Starting from Tripoli in 1869 he went by way of Fezzan to Bornu, and after excursions into neighbouring states he returned by way of Darfur, Kordofan, and Cairo in 1874. He

embodied the results of this expedition in *Sahara and Sudan* (3 vols.). In 1884 he was sent to arrange the annexation of the German possessions on the west coast of Africa, but died off Cape Palmas.

Nadir is the point in the heavens immediately beneath our feet; it is therefore the zenith (q.v.) of a place on the opposite side of the earth. Every place has its own zenith and nadir, these two points forming a straight line with the centre of the earth. Since this straight line is a vertical line for the place in question, and the horizon is a plane perpendicular to it, the zenith and nadir are respectively the upper and lower poles of the horizon.

Nadir Shah (1688–1747), King of Persia, was born at Khorassan; he soon distinguished himself in the service of the Government of Khorassan. Having failed to upset the government of the province, he became a bandit-chief, and captured several fortresses. Struck by his talent for war, the Shah Ashraf made overtures to him, and appointed him to the command of the Persian army against the Afghans, whom he defeated in many engagements. In 1730 he was employed against the Turks, receiving high distinction for his services; but, disgusted at the peace made by his master, and ordered to disband his army, he led 7,000 men to Ispahan, deposed the Shah in favour of his young son Abbas, and established himself as regent. He again attacked the Turks, and regained some ceded provinces. At the death of Abbas, in 1736, Nadir became king, and resolved to invade India. At the head of 120,000 men he advanced to Delhi, took it, and ordered a general massacre, and secured an immense booty. He then made peace with the Mogul, married his daughter, and received with her some of the provinces bordering on Persia. He then attacked Bokhara, and finally obtained dominion from the Indus and Oxus to the Euphrates and the Caspian Sea. He was eventually assassinated, and his nephew, Kouli Khan, was put upon the throne.

Nævius, CNÆUS, an early Roman poet, flourished in the 3rd century B.C. He was born in Campania, and composed tragedies and comedies upon Greek models, as well as an epic upon the Punic War, and another after the pattern of the Cyprian Ilias. His satire upon the Roman aristocracy led to his banishment, and he died at Utica. Fragments only of his works are extant.

Nævus. This is a term applied to a pigmented patch of skin, or to an overgrowth of capillaries bound together by connective tissue (the ordinary *capillary nævus*), or, again, to the tumours containing inter-communicating spaces more allied to veins than to capillaries, the *venous* or *cavernous nævus*. Nævi usually exist from birth; they often remain practically stationary; they may undergo gradual enlargement or may waste away and disappear. Capillary nævi usually affect the skin of the head and face. Save for the disfigurement they cause, they are of little importance. In some instances it may be advisable to excise a small nævus, or to treat it by the application of caustics.

Naga. 1, A large Tibeto-Burman people, who give their name to the Naga Hills, south and south-east Assam, Manipur, and Burmah frontiers; over thirty distinct tribes, mostly speaking different languages and forming three main divisions, the western, central, and eastern Nagas. Of all the Naga tribes by far the most powerful are the Angami of the central division, who occupy a large territory eighty by fifty miles between Assam and Manipur. For many years they gave great trouble to the British authorities in South Assam, but, after protracted frontier wars, were all reduced about 1885–86. The proper national name is *Nega*—i.e. “People”—and has nothing to do with the Sanskrit *Naga* (“snake”), nor are they Serpent-worshippers.

2, An ancient Indian people who traditionally ruled over a great part of the Indus Valley, with Patala and other cities as their capitals. They were of Sanskrit speech and apparently Aryans, with the Naga (snake) as their totem, and from the earliest times opposed to the Brahmins, by whom they were stigmatised as *Asuras*—i.e. Suras or Devas. With them originated the Buddhist and Jaina tenets, and Buddha himself was probably a Naga, whence the connection between the snake and these forms of religion. In the Puranas and other later writings the Nagas pass into the region of mythology and are no longer a historical people, but supernatural beings, or actual serpents. (Oldham.)

Nagasaki, a Japanese city and fort, is situated on a peninsula and the extremity of a bay upon the west coast of the island of Kiusiu. The bay, which is surrounded by hills upon which part of the town is built, affords a good anchorage. It has a mild and healthy climate, though rain is prevalent in the summer months. Until 1858 only the Dutch were admitted to trade, but the town then became one of the five treaty-ports opened to Great Britain and the United States, and was afterwards thrown open to other European nations. Its productions are copper, silk, camphor, tobacco, porcelain, and lacquered-ware, and there is a large export trade.

Nagor (*Cervicapra redunca*), a reedbuck from western Africa, in which the horns have a strong forward curve.

Nagpur, a division of the Central Provinces of India, having an area of 24,000 square miles, with a capital of the same name. The town is 440 miles N.E. of Bombay and, together with its suburbs and surrounding cultivated lands, lies somewhat low. It is well furnished with trees, and has fine tanks, gardens, and Hindoo temples of fine architectural character. On the Sitabaldi Hill, in the neighbourhood, is a fort with a small European garrison. Cotton and woollen cloths are manufactured, and there is a brisk trade in corn, cloth, salt, and European goods. Coal and iron are found, and the opening up of the country will probably bring them into prominence. Aboriginal tribes are numerous in the district. It was governed by rajahs till 1853.

Nahua, the primitive stock, whence are supposed to have sprung the historic and civilised peoples of the Mexican (Anahuac) plateau: *Toltecs*.

pyramid-builders, 6th century; *Chichimecs*, 11th century, probably not originally Nahuas, but absorbed by them in 14th century; *Aztecs*, 15th century, founders of the last Nahua empire, with capital Mexico, overthrown by Cortes (1520-21). Branches of the Aztecs were the confederate *Acolhuas*, capital Tezcuco, and *Tepanecs*, capital Tlacopan. These and all others speaking the pure Aztec (Mexican) language claimed to be true Nahuas. The group does not comprise the Miztecs, Zapotecs, and other civilised peoples of Mexico who were not of Aztec (properly Nahuatl) speech. The full form of the word is *Anal-huate* ("Amid-the-Waters"), in reference to the flooded depressions of the plateau round which were settled the original Nahua peoples.

Nahum, one of the twelve minor prophets of the Old Testament, prophesied the destruction of Nineveh as a just punishment for persecuting the people of Israel, and endeavoured to raise the spirit of his nation; but some critics place him after this destruction took place.

Naiad. [NYMPH.]

Naididæ, a family of small worms of the order Oligochaeta; it includes the common river red worm. *Tubifex rivulorum* (q.v.).

Nail, a horny growth consisting of modified epithelial cells; it rests upon a bed of skin, which is called the matrix of the nail, and the cells of this matrix are in a condition of active growth (reproduction and transformation), by which the body of the nail is continually renewed, the formation of fresh horny tissue taking place from beneath and behind, so that the nail gradually grows forward and projects beyond the tips of the fingers and toes.

Nails. A nail is a small piece of metal (usually iron) consisting of a slender spike and a head, which is commonly round or flattened. Nails are driven into wood and various other substances in order to hold separate pieces together. They are sometimes distinguished according to the character of their heads; thus the head of the *clasp* has pointed spurs, that of the *clout* is round and flat, and the *rose* has a conical head hammered into triangular facets. The smaller kinds of nail include the *taek*, a short sharp nail with a flat round head, used in upholstery and saddlery; the *brad*, used in nailing ceilings and floors, the head of which is merely a slight projection on one side; and the *sprig*, a sharp taper nail, with no head, used in shoe-making.

Nair, a Dravidian people of south-west India, formerly dominant in Malabar and Travancore, where they are still numerous and influential. Although classed as Sudras by the Brahmans, they claim to belong to the higher Kshatriya, or warrior, caste, with eleven minor divisions, numbering altogether nearly a million. The Nairs—i.e. "Masters"—are an extremely haughty people, great sticklers for their assumed social privileges, and holding in contempt all other classes except the Brahmans. They still retain the primitive matriarchal usages and traditions in full vigour,

and till the middle of the 18th century Travancore was ruled by Nair princesses succeeding in the female line. In the family group also authority is exercised by the mother and eldest daughter, whom the maternal uncles and brothers obey implicitly, while the husbands are of no account, often dismissed altogether after the marriage, or else only tolerated as guests in the household. Land also is transmitted in the female line from mother to daughter, and cultivated by all the sons for the benefit of the community. Polyandry, formerly universal, appears to be disappearing, and unions, as at present constituted, may be described as "a contract based on mutual consent and dissoluble at pleasure." (Thévenot, Clements Markham.)

Nairne (CAROLINE OLIPHANT), BARONESS (1766-1845), was born at Gask, in Perthshire, and belonged to a family of strong Jacobite opinion. In 1806 she married Major Nairne, who became Baron upon the reversal of an attainder. She lived at Edinburgh, and then, as a widow, upon the Continent and in Ireland, finally returning to Gask. Under the signature "B. B." she wrote many songs, among them being *Caller Herrin*, *Land of the Leal*, *Laird of Cockpen*, and *The Auld House*.

Nairnshire, a county in the N.E. of Scotland, having the Moray Firth on the N., Elgin on the E., and Inverness on the S. and W. It is 24 miles long by 15 broad, and contains 197 square miles, of which about one-quarter is under cultivation. The southern part, of granitic formation, is hilly, while the valleys are of old red sandstone, and marl and freestone abound. The chief rivers are the Findhorn, renowned for its scenery, and the Nairn, flowing almost parallel from S.W. to N.E., and taking their rise in Inverness-shire. The soil on the coast is sandy and light, but the soil inland is rich and fertile. The county unites with Elgin to return one member to Parliament. Nairn, the capital, is a seaport near the mouth of the Nairn, and on the Highland railway. There is harbourage for small vessels, and fishing is carried on, and the town has a rising reputation as a watering-place. Nairn is one of the Inverness burghs.

Nakong (*Tragelaphus spekii*), Speke's Antelopes, named in 1864 from the skin and horns of a male brought home by Captain Speke. These animals, which live in the country round Lake Ngami, have long, loose mouse-coloured fur, and their hoofs are enormously developed, enabling them to travel well over swampy ground.

Nalu, a people of the low coastlands between the Cassini and the Rio Pongo rivers, Senegambia, whose "king," Yora Towell, accepted the French protectorate in 1865. They speak a dialect of the widespread Susu language (itself a branch of the Mandingan), and all were forcibly converted to Mohammedanism by the Fulahs of the neighbouring Futa-jallon uplands early in the present century. Nevertheless, they still preserve many pagan usages. Like their Landuman and Baga neighbours, the Nalus are of somewhat pronounced Negro type.

Namaqua, the chief branch of the Hottentot race, who give their name to the extensive regions of Little Namaqualand, south of the Orange river, and Great Namaqualand, extending from the Orange northwards to Walfisch Bay. [HOTTENTOTS.]

Namburi, a people of the Malabar coast, south-west India, of Dravidian stock and speech, but claiming to be Brahmans, though abhorred by the orthodox Brahmans, who regard them as little better than outcasts because of their matriarchal customs. Owing to the restrictions placed on marriage, they are decreasing; but they still possess great influence over the surrounding populations, on whom they have imposed their social observances sarcastically called the "sixty-four abuses." One of these, however, is a scrupulous adherence to the truth, so that all questions are answered with great deliberation to guard against the least inaccuracy even in the most trivial matters.

Namollo, aborigines of north-east Siberia at the mouth of the Anadyr river and along the west coast of Behring Strait; show strong Eskimo affinities, but whether due to common descent or to intercourse and mixture is uncertain. By some observers they are allied to the Chukchis, forming the fishing section of that race; but the language is wholly distinct, though evidently affected by Eskimo influences. (Bove, *Bol. Italian Geographical Society* December, 1879.)

Namur, a province of Belgium, having Brabant on the S., Liège on the N.E., Luxembourg on the E., Hainault on the W., and France on the S. and S.W. It is 57 miles long by 37 wide, and contains 1,413 square miles, and is of much strategic importance in the new scheme of Belgian frontier fortification. The surface, with the valleys of the Meuse and Sambre, is well wooded, while the soil is carboniferous, and produces coal and iron, good timber, together with corn, oil-seeds, fruit, and dye-plants. The river Meuse, with its tributary the Lesse, from the S., and the Sambre from the W., unite at the town of Namur and flow E. The majority of the population is Walloon. The capital, Namur, at the junction of the two rivers, is at the foot of a height upon which is the citadel. It is protected by five large, and four small outlying forts. The parts of the town are connected by several bridges; but, owing to many bombardments, there are few old buildings. The modern cathedral is fine, and, besides the Hôtel de Ville, the Belfry, and the arsenal, there are numerous schools, colleges, and public institutions. The chief industry is the manufacture of cutlery, other occupations being leather-working, and iron- and brass-founding, Namur was taken by the English in 1695.

Nana Sahib (b. 1821), or DUNDHU PANTH, was adopted by the ex-Peishwa of Mahratta. He was born in the Deccan, his father being a Brahmin. At the death of the Peishwa, in 1851, Nana expected the former's pension to be continued. Disappointed in this matter, he intrigued against the British and, at the outbreak of the Mutiny, was proclaimed Peishwa, and made himself infamous by the

massacre of Cawnpore. After the quelling of the Mutiny he escaped to Nepal, where he is reported to have died.

Nancy, a town in the N.E. of France, capital of the department of Meurthe and Moselle, is pleasantly situated in a fertile plain near the left bank of the Meurthe, 177 miles E. of Paris, and on the railway to Strasburg. It consists of the old and new town, and suburbs. The old town, which contains some fine public buildings, has narrow irregular streets, but in the new, the streets are wide and regular. The Place Stanislas, from which a triumphal arch leads into the handsome Place Carrière, has a statue of Stanislaus of Poland, who lived here as Duke of Lorraine. The Cours Léopold and the Pepinière are finely-planted. The modern cathedral, the Church of the Cordeliers (with tombs of the Dukes of Lorraine), the Hôtel de Ville, and the seven gates are worthy of note. The manufacture of broadcloth, cotton, yarn, hosiery, lace, and embroidery, together with brewing, dyeing, tanning, and iron-working, are the chief industries. From 1870 to 1873 Nancy was in the hands of the Germans.

Nankeen, a kind of cotton cloth made at Nankin in China, whence its name. Its peculiar yellow tint belongs to the cotton itself. In the earlier half of the 19th century clothing made of nankeen was much in vogue in England, and cloths bearing a strong resemblance to the genuine stuff were manufactured in most European countries. The name is now used in a more extended sense.

Nankin, a Chinese town, capital of the province of Kiang-su, extends from the right bank of the Yang-tse-Kiang to a distance of three miles. The town, which is 560 miles S.E. of Pekin, is eighteen miles round, and is surrounded by a wall 40 feet high. The river, which is here $1\frac{1}{2}$ miles broad, is very deep, and runs with a strong current. Between the walls and the river is marshy land crossed by causeways, and a deep ditch leading from the river affords protection on the W. A party-wall separates the Manchoo and Chinese quarters. The city, which is a great literary centre, is the residence of the Governor-General of three provinces with his official staff. The streets are fair, but the houses insignificant, and the inhabitants are largely employed in the production of satin, crape, nankeen, paper, ink, and artificial flowers made from pith. Till the 13th century Nankin was the Chinese capital, and from 1853 till 1864 it was in the hands of the Taepings, who wrought much havoc upon it.

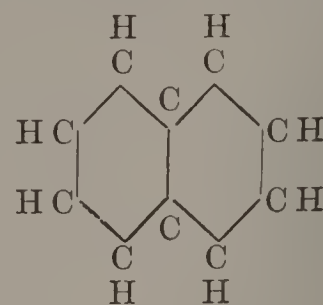
Nan-Man, *i.e.* "Southern Barbarians," a term applied in the early Chinese records to the aborigines about Lakes Tungling and Poyang, whence they were driven to the Nan-ling Mountains. Here they are divided into a great number of different tribes, some of which are grouped as Miao-tze (q.v.). The "eighty-two tribes" described in a Chinese work translated by Bridgeman are all Nan-Man, and with them must also be classed the Tung of Kwangsi, the Kilao and Taman of Kweichew and many others.

Nantes, a town of Western France, capital of the department Loire Inférieure, is situated upon the right bank of the Loire near the infall of the Erdre and Sèvre, 269 miles S.W. of Paris, with which it is connected by railway. Part of the town is on two of the islands which here stud the Loire, and there are sixteen bridges. It is one of the finest towns in France, having good squares, and two miles of quays, while its position, 40 miles from the ocean, makes it convenient for commerce, large vessels, however, not ascending higher than St. Nazaire. Among the chief public buildings are the 15th-century cathedral, with sculptured entrances and fine monuments; the modern Gothic church of St. Nicholas with a tower 278 feet high; the 14th century castle, the Palais de Justice, the Hôtel de Ville, and a picture gallery. The chief manufactures are blankets, serge, flannel, prints, ship's boilers, etc., canvas, cordage, and chemicals, and there are cotton-mills, sugar, iron, glass, and bleaching-works, and a large trade is done in sardines and preserved meats. The foreign trade is extensive, and the building docks employ many hands. The town is of historic interest. It passed with Anne of Brittany to the French crown in 1499, and is famous for the Edict of Toleration issued in 1598 by Henri IV. and revoked by Louis XIV. in 1685, and for the Noyades which took place here during the Revolution.

Naphtha, a term applied to a number of inflammable organic liquids occurring naturally, as in *petroleum* (q.v.), or obtained by the distillation of organic products, as *wood naphtha*, *bone naphtha*, etc. Two products are commonly known under the name, *i.e.* the petroleum and coal naphthas. The first of these consists of the lower boiling portions of the petroleum, with a specific gravity varying from about .65 to .75. By further separation it gives the liquids *gasoline*, *benzine*, *benzoline* (q.v.). Coal naphtha is obtained by the distillation of the coal tar, and is that portion which boils below 200° C. and possesses a specific gravity of from .86 to .90. The yield of naphtha from coal-tar varies with the different kinds, reaching from 5 to 20 per cent. of the tar. Both consist of mixtures of different hydrocarbons, *i.e.* compounds of carbon and hydrogen. Naphtha finds many applications industrially, being largely used as a solvent for resins, oils, greases, indiarubber, guttapercha, wax, etc. It is also employed in perfumery, and largely as an illuminant, especially for the open flaring naphtha lamps.

Naphthalene is a hydrocarbon of the composition represented by $C_{10}H_8$. It is formed by heating many organic substances, and is on this account present in coal-tar, in which it was first discovered in 1819. From this source it may be obtained by allowing the portions of the tar which boil at from 180° to 200° C. to crystallise. After purification it is obtained as a white flaky solid, with a peculiar aromatic odour. It melts at 98°, and boils at 218° C., but sublimes readily at lower temperatures. It forms very many important compounds—the naphthalene derivatives, many of which are employed in

the manufacture of various dyes. The study of these compounds indicates that the constitution of naphthalene is best represented by—



(*Cf.* BENZENE.)

It is employed in the albo-carbon gas-burners, and is also used as an insecticide and preservative.

Napier, SIR CHARLES, British naval commander, was born in 1786, and entered the navy in 1799. In 1807 he was made a commander, and as such witnessed the reduction of the islands of St. Thomas and St. Croix, assisted in the cutting out of a Spanish ship lying under batteries off Porto Rico, took Fort Edward, Martinique, and was posted (1809). He was afterwards made a C.B. The long peace not providing him with sufficient employment at home, he, in 1833, accepted an appointment as admiral of Dom Pedro's fleet, and in that capacity gained a great victory over a Miguelite squadron off Cape St. Vincent. In 1839 he was sent to the Mediterranean, where, under the direction of Sir Robert Stopford, he rendered good service during the operations of 1840 on the coast of Syria. For this he was made a K.C.B. In 1846 he became a rear-admiral, and in 1853 a vice-admiral. In 1854 he was, at the outbreak of the war with Russia, made commander-in-chief in the Baltic, but effected little. Promotion to the rank of admiral followed in 1858, and Sir Charles died in 1860.

Napier, SIR CHARLES JAMES (1782–1853), entered the army at an early age, and was aide-de-camp to Sir James Duff during the Irish Rebellion. In 1803 he was captain in the 50th Foot, and as major was wounded and made prisoner at Cornnna. In 1811 he was wounded at Busaco, and afterwards took part in the American War, returning to Europe just too late to be present at Waterloo. After other employments, he was sent in 1841 to command as major-general in the Bombay Presidency. It was at this period that he made his famous conquest of Scinde, after which he became Governor of the new province. He was devoted to Lord Ellenborough, who had appointed him, and after the latter's recall took an early opportunity of resigning his post. In 1849 he was again in India as commander-in-chief, but a difficulty with Lord Dalhousie caused him to throw up this, the last of his public employments.

Napier, ROBERT CORNELIUS (LORD NAPIER OF MAGDALA) (1810–90), was born in Ceylon, and educated for the Indian service at Addiscombe. He entered the Bengal Engineers, and took part in the Sutlej campaign, and also in the Sikh War, being engineer-in-chief at the siege of Mooltan (1848), and being present at the battle of Goojerat. In 1857 he was chief of the staff to Sir James

Outram, and was engineer of the works by means of which Sir Colin Campbell relieved Lucknow. He was employed by Sir Hugh Rose against Tantia Topee, was second in command in the Chinese campaign of 1860, and in 1865 was commander-in-chief of the Bombay army. His expedition against Theodore of Abyssinia in 1868 and the capture of Magdala brought him a peerage and pension. He returned to India as commander-in-chief in 1870, became Governor of Gibraltar in 1876, and was appointed Constable of the Tower in 1887.

Naples, a town of South Italy, capital of the province of Naples, and once capital of the kingdom

sites of ancient temples, has granite pillars and ancient marbles, and contains relics of St. Januarius. The Royal Palace contains some good paintings, and the Palace of Capo di Monte has modern paintings, sculptures, and fine gardens. The Museo Nazionale contains a library of 275,000 volumes, valuable MSS., the Farnese paintings and sculptures, and relics of Herculaneum and Pompeii. Educational, literary, and scientific institutions abound. Among the productions are macaroni and vermicelli, articles in coral and lava, and cameos. In the neighbourhood are many objects of interest, the tomb of Virgil, Vesuvius, the remains of Herculaneum and Pompeii, and ancient villas,



THE BAY OF NAPLES, WITH VESUVIUS. (From a photograph by Frith & Co., Reigate.)

of Naples, is one of the chief naval and military ports of Italy. It is situated upon a beautiful semicircular bay on the west coast, and is 117 miles S.E. of Rome. The town is partly on the shore and partly on the hill-slopes, having on the W. the heights of Posilipo, and on the E. Vesuvius. The best view of it is from the W. heights, or from the sea. There are three forts—of no practical use now—St. Elmo on the hill to the west, Castello Nuovo near the sea, and Castello di Oro on a rocky islet which is joined by a jetty to the mainland. The city, which is divided by a steep ridge from Castello di Oro to St. Elmo, is three miles long by two broad, not counting the suburbs, and has an arsenal, a naval harbour, and a mercantile harbour. There are several gates—some now inside the city—the Capua gate being adorned by sculptures in relief. The streets are regular and clean though narrow, and are well paved with blocks of lava. There are many fountains and fine promenades, among the latter being the Riviera di Chiaja, close to the Villa Nazionale Gardens. The fashionable quarter is to the west, the road of communication being the Corso Victor Emmanuele. The cathedral of 1272, built on the

temples, and tombs. There is a good export trade, though the harbour is insignificant. The population is unique in its character. Originally a Greek colony, the city was called Neapolis (new city) to distinguish it from Parthenope. Hadrian and Constantine in later times did much towards embellishing it, and in 536 and 542 it was pillaged by Belisarius and Totila respectively. When capital of the kingdom it belonged successively to Normans, the German Emperor, and to the kings of France and Spain. After the revolution in France the crown was given, first to Joseph Bonaparte, and then to Murat. Then after being misgoverned for many years by its Bourbon kings, it was taken by Garibaldi in 1860, and was annexed to the kingdom of Italy. The Bay of Naples is 20 miles across from Cape Misenum to Cape Campanella, and extends 20 miles inland. At the northern part of the entrance are the islands of Ischia and Procida, and at the south is Capri, the city being on the northern shore.

Napoleon, a round game at cards. Five cards are dealt to each of the players, who declare in turn, beginning at the dealer's left, how many

tricks they will attempt unless they elect to pass. A declaration of *Nap*—i.e. the whole of the five tricks—overrides all others. The player who declares for the largest number of tricks has to play, and the others must follow suit if possible. If he succeeds, he receives a certain amount for every trick from each of the other players, and, if he fails, pays a corresponding amount to them.

Napoleon Bonaparte (1768–1821), a member of a family of Greek origin, but for some generations settled in Corsica, was educated at the military college of Brienne, where he formed the friendship of De Bourrienne, his future secretary and biographer. The death of their father reduced the Bonaparte family to poverty, and Napoleon, on joining the artillery regiment of La Fère in 1785, found difficulty in gaining a bare subsistence. It was probably owing to his early years of severe economy and self-denial that he gained the strength of mind and will so thoroughly developed at the outbreak of the Revolution. In 1793 Bonaparte was employed with the rank of captain at the siege of Toulon, at that time held by a British force in conjunction with French Royalists. As commander of the artillery he gained by force of character an ascendancy over Carteaux, the general. Having persuaded the latter to attack Fort Eguillette, commanding the two harbours of Toulon, the withdrawal of the English naval squadron and the evacuation of the town followed the capture of this vital point. This success gained for Bonaparte the rank of general of brigade and employment with the Army of Italy, where he earned additional laurels (1794). Meanwhile the torrent of Revolutionary fury had spent its force. Robespierre had been executed, and the Reign of Terror was at an end. From the outset Napoleon had profoundly mistrusted the enthusiasm of the Jacobins, while his mind revolted from their excesses. Yet motives of policy and admiration of their success had induced him to make friends with men of the most extreme faction, among whom the younger Robespierre had been his intimate companion.

The young general was now arrested as a Terrorist, and it was only after days of the utmost anxiety that, nothing having been proved against him, he was released. In 1795 Bonaparte was summoned to Paris, but, having declined service in La Vendée, his name was struck off the active list: called in, however, shortly afterwards to subdue the revolt of the Sections, his success was rewarded by his appointment as Commander-in-Chief of the Army of Italy. In March, 1796, having a few days previously married Josephine, widow of the Vicomte de Beauharnais, Bonaparte assumed command. His troops to the number of about 40,000 were occupying the passes of the Northern Apennines. Opposed to them was an allied force of Austrians and Sardinians of rather greater strength, but widely extended. Concentrating with rapidity, the French general threw himself against the allied centre, broke it at Montenotte and Millesimo, overtook the Sardinians, who were retiring separately northwards, at Mondovi, defeated them again, and before the end of April had forced their sovereign

to make peace under the very walls of Turin. Turning without delay to the Austrians, he moved swiftly along the valley of the Po, forced the passage of the Adda at Lodi, and entered Milan in triumph on the 18th May. Nor did he even then rest on his laurels, but with a succession of victories at Lonato, Castiglione, Arcola, and Rivoli completed the discomfiture of the enemy, and closed his campaign by the capture of Mantua (January, 1797). He was now ordered to Rome, where he gained an easy conquest over the Papal troops. Having returned to Mantua, and being reinforced from France by 20,000 men, Bonaparte next turned his arms northwards, violated without hesitation the territory of Venice, forced the passage of the Tagliamento, entered Carinthia, nor halted until, when within 30 miles of Vienna, the Austrian Emperor sued for peace, the terms of which—including the appropriation of Venice by Austria—were ratified at the treaty of Campo Formio (October, 1797).

On his return to France Bonaparte was first offered command of the Army of England, and afterwards that of an expedition to Egypt, undertaken apparently by the Directory at his own instigation, with the rather vague idea of opening up communication with Tippoo Sahib in India, and possibly of founding an Eastern Empire. Having defeated the Mameluke forces near the Pyramids and having occupied Cairo, the general proceeded to invade Syria, but was repulsed from the walls of St. Jean d'Acre by Captain Sidney Smith, acting in conjunction with Djezzar Pasha; and, his troops being decimated by the plague, Bonaparte was compelled to return to Egypt. Here he received intelligence that matters had been going ill for France both at home and abroad. The Austrians had reoccupied Italy, and the government of the Directory was evidently shaken to its foundation. He resolved to return home, but the chances of doing so appeared desperate. Shortly after the landing in Egypt his fleet had been destroyed by Nelson at Aboukir, and the Mediterranean swarmed with British cruisers. Accompanied by a few friends, he nevertheless made the venture and, after many hairbreadth escapes, landed at Fréjus in October, 1799. It had not been until after Lodi that Bonaparte had cherished the idea of becoming ruler of France. The favourable opportunity had now occurred; encouraged by the acclamations of the people and assured of the support of the army, by a *coup d'état* he speedily overthrew the Directory, and established himself as First Consul with Cambacérès and Lebrun for his colleagues. Called to supreme power by the enthusiasm of the people, possessed of almost despotic authority, and, trampling under foot the embers of the Revolution, a series of laudable acts followed his elevation. *Emigrés* were released from prison, the law of hostages was abolished, and 9,000 state prisoners received their liberty. It was now time to turn to Italy, where matters had gone badly for the French. Massena, commander-in-chief, was shut up in Genoa; Suchet with difficulty held the line of the Var. General Melas, with the Austrian main body, occupied Piedmont. With brilliant conception and execution the First Consul crossed the Great St.

Bernard, struck the neck of the Austrian communications, and inflicted a crushing defeat on Melas at Marengo (June 14, 1800). A capitulation ensued, and Bonaparte returned to Paris. North of Switzerland Moreau's army proved equally successful, and gained the decisive victory of Hohenlinden. Prolonged negotiations followed, but at length by the treaties of Lunéville and Amiens (March, 1802) a general peace was concluded. The First Consul was now occupied with matters of internal administration; the Cadastre, or Land Survey, was reformed, the Code Napoléon established, finances put in order. France appeared to be inaugurating a new era, but mistrust of England and complaints freely reciprocated proved too strong, and in May, 1804, war was again declared. The object of Bonaparte was now to invade England; an army of 130,000 men was assembled near Boulogne, and the First Consul repeatedly declared that, given the command of the Channel for forty-eight hours, England was at his mercy. Meanwhile usurpation of power had been attended by its usual consequences. A conspiracy, headed by Georges Cadoudal and the Chouan chiefs, had been detected. Many distinguished persons, including Generals Pichegru and Moreau, were implicated. A previous attempt at assassination had narrowly failed, and the Consul's life was evidently in instant peril. Cadoudal and a few others were executed, but still stronger measures followed. The Duc d'Enghien, son of the Duc de Bourbon, was seized within the territory of Baden, forcibly conveyed to Vincennes, arraigned before a military court at midnight, and immediately shot. As the year wore on, it became evident that the First Consul contemplated assuming the crown. In May the Senate declared Napoleon Emperor of the French, the decree being subsequently ratified by the almost unanimous vote of the nation, wearied of the despotism and incompetency of the republic and assured that a monarchy could alone produce tranquillity and order. The coronation took place in December, while in the following year Napoleon assumed in addition the iron crown of Lombardy. In August, 1805, the utter failure of the Emperor's naval combinations showed that the contemplated invasion of England was an impossibility. Without delay he resolved to transport this army, now in the highest state of efficiency, to take the field against Austria and Russia. His march to the Danube stands out as a model of speed, calculation, and effect. On the 20th of October the Austrian general, Mack, surrendered at Ulm with 30,000 men. Three weeks later the Emperor entered Vienna, and, on the 2nd of December, was face to face with the united armies of the Allies at Austerlitz. An attempt to encircle his right flank was met by a vigorous attack on their weakened centre, which broke and was carried away in headlong flight, while the left wing of the Allies, assailed in front and flank and driven to retire across the frozen waters of Lake Satschau, found a watery grave beneath the ice quickly broken in pieces by the remorseless artillery of the French. The Russians retired northwards while the Austrians concluded a separate peace.

During the following year Napoleon achieved his favourite project of a confederacy of the Southern

German States in alliance with France and called the Confederation of the Rhine. Meanwhile the Prussians had taken fire at the insults and exactions of French troops in German territory, and early in October declared war. The French army, still on the right bank of the Rhine, was instantly put in motion and the Prussian forces annihilated on the 14th October, 1806, at the battles of Jena and Auerstadt. By this time the Russian army had again taken the field. Napoleon, entering Poland, encountered it at the indecisive fields of Pultusk and Eylau, but in the following June the decisive battle of Friedland, coupled with the refusal of the English Whig Government to render assistance, determined the Russian Emperor to make overtures of peace, and the Treaty of Tilsit was concluded in July, 1807, by the terms of which Prussian Poland was converted into the Grand Duchy of Warsaw and the Prussian provinces on the left bank of the Elbe formed into a kingdom of Westphalia, while mutual advantages were reaped by France and Russia.

Napoleon now set to work to ruin England through her commercial trade. By means of what was termed the "Continental system" he attempted to exclude British goods from Continental ports. His scheme proved a failure, and even at the time when he was boasting of having struck a mortal blow his own armies were being clothed from Leeds and Northampton.

Meanwhile difficulties were arising in Spain. King Charles IV. having abdicated, his son Ferdinand placed himself in Napoleon's power and was detained a prisoner. The Emperor seized the pretext for interference. An army under Murat occupied Madrid; insurrections quickly broke out, and the French abandoned the capital. At this crisis Napoleon, finding his presence indispensable, crossed the frontier with 300,000 men, and once more captured Madrid (December 3rd, 1808). Alarming news soon reached him; a British force under Sir John Moore had advanced from Portugal, and was threatening the vital point of his line of communications. Quitting Madrid on the 20th, and crossing the Guadarrama Mountains in a tempest of hail and snow, the Emperor traversed 200 miles in ten days in the hope of cutting off his daring adversary. Moore, however, aware of his danger, had made good his retreat, and the blow failed. On the 1st of January, 1809, intelligence arrived of the imminence of hostilities on the part of Austria. Napoleon flew to his army in Germany, concentrated it in the valley of the Danube, gained the victory of Eckmühl and occupied Vienna (May 12th). Repulsed by the Archduke Charles in an attack on Essling, the Emperor's position was for a time one of great danger until, on the 6th of July, the victory of Wagram terminated the war.

In the following year, Napoleon, desirous of an heir, divorced Josephine and married Marie Louise, daughter of the Emperor of Austria. He now contemplated resuming command in Spain, but difficulties with Russia, the result of mutual jealousy and mistrust, arose. In 1812 the climax was reached. Napoleon with an immense army, of which his allies contributed the greater part, crossed the

Niemen, gained the indecisive battle of the Borodino, and occupied Moscow on the 14th of September. During the same night fires broke out in all directions and the city became untenable. The Russians declined all negotiation. Napoleon's hopes were frustrated; winter was at hand. A retreat became inevitable, and was begun on 26th of October. Disasters accumulated; news arrived of the British occupation of Madrid. The French army had already lost four-fifths of its numbers, and the strength of the Russians enforced a retreat over the same line—now devastated—by which the French had originally advanced. Smolensko was reached; but the retreating army soon degenerated into a mob of stragglers, and the terrible passage of the Beresina (November 28th) completed its wreck. On the 5th of December the Emperor, who had received news of a dangerous conspiracy at Paris for his overthrow, found himself compelled to quit the army and resume the government of France. The miserable remnant of the Grand Army, abandoning successively the lines of the Vistula and Oder, halted at length on the left bank of the Elbe. A crisis was evidently at hand. Prussia flew to arms. The efforts of Napoleon gathered 200,000 men to his standard. Joining the army in person, he defeated the Allies at Lutzen, reoccupied Dresden, and followed up his success by a victory at Bautzen. The Allies retreated to the Oder, and an armistice resulted. Negotiations ensued, but in August the Allies, with the adhesion of Austria, again took the field. Notwithstanding a defeat at Dresden, their numerical superiority began to tell. The French concentrated at Leipzig and for two days held their ground in the face of overwhelming numbers. A retreat then became inevitable, and early in November the shattered remains of the army recrossed the Rhine into France. The campaign of 1814 shed a last ray of glory upon Napoleon's arms. Never had his talents been displayed with greater brilliancy. Pivoting alternately between the Aube and Marne, he struck blow after blow at the invading armies. Ultimate success might still have attended him, but the capitulation of Paris and the utter weariness of war shown by the French nation caused his abdication (April 6th, 1814). Escaping in the following year from Elba, whither he had been exiled, he again occupied the imperial throne. The Allied Powers refused to acknowledge him, and their armies again surrounded the frontier. Napoleon's only chance was to take the offensive and separate the combined English and Prussian forces assembling in Belgium; but the numbers at his command (125,000) were quite inadequate to make head against the 206,000 of his opponents, and, though the rapidity of his blow gave him a momentary advantage, the battle of Waterloo proved a deathblow to his hopes; and, after a second abdication, the remainder of his life was lingered out on the rock of St. Helena.

Napoleon III., CHARLES LOUIS NAPOLEON BONAPARTE (1808-73), was born in Paris, being the son of Louis Bonaparte, King of Holland, and of Hortense Beauharnais. After the downfall of the First Empire the young prince lived with his

mother at Augsburg, and then near Lake Constance. In 1830 he took part in the Papal Revolution. On its failure he fled to France, but was compelled to leave, and, after a stay in England, again went to Constance. In 1831 the Polish crown was offered to him, but the Polish movement proved abortive. The death of the Duke of Reichstadt made Louis head of the family. In 1836 he made an attempt to seduce the garrison of Strasburg, and, being made prisoner, was sent to the United States, but his mother's fatal illness brought him back to Europe the next year. France called on Switzerland to extradite him, and to prevent complication, Napoleon went to England. In 1838 he published *Idées Napoléoniennes*. The enthusiasm aroused in France by the translation of Napoleon I.'s remains to Paris in 1840, led Louis to make his descent on Boulogne, the result of which was his trial and condemnation to imprisonment in the fortress of Ham. Here he wrote and studied much till his escape in 1846, when he came to England. In 1848 he went to Paris, and professed republican principles, but again retired to England. Returning to Paris, he was elected deputy, and by means of the popular vote was elected Prince-President the same year. In 1851 he was elected President for ten years, and in 1852 by the *coup d'état* made himself emperor. In 1853 he married Eugénie de Montijo, and in 1854 became England's ally in the Crimean War. In 1858 a coolness arose between France and England, but in 1859 Queen Victoria visited the emperor at Cherbourg. In this year he joined Sardinia against Austria, and the campaign, after the victories of Magenta and Solferino, resulted for France in the cession of Nice and Savoy. In 1860 Napoleon took part with England in a joint expedition against China, and in 1861 France, England, and Spain made common cause against Mexico. England and Spain, however, withdrew, and Napoleon alone entered on the expedition under Bazaine which ended in the appointment of Maximilian as Emperor of Mexico and the tragedy of Queretaro. In 1866 troubles began with Prussia on Napoleon's proposing a reconstruction of frontier. The next year the ill-feeling was increased by the proposal of ceding Luxembourg to France, a proposition which was settled by the neutralisation of Luxembourg, and in 1870 the question of electing a German prince to the Spanish throne precipitated the inevitable war. At Saarbrück the emperor and his son were present; but the shutting up of one French army in Metz, and the defeat of another at Sedan, finished the campaign. Napoleon surrendered, and remained a prisoner at Wilhelmshöhe till the spring of 1871, when he joined his wife and son at Chislehurst, where he spent the remainder of his life. The Prince Imperial, five years after his father's death, was killed by Zulus while on a British reconnoitring party.

Narbonne (Roman *Narbo*, and capital of Gallia Narbonensis), a town of southern France, near the Mediterranean, in the department of Aude. The town is on a plain surrounded by hills, and is 33 miles E. of Carcassone. The

streets are irregular, and the Robine Canal flows through the town. Among the good promenades possessed by it are the Esplanade and the Allée des Soupers. The 13th-century church of St. Juste, the town-hall with lofty tower, the barracks, and hospital are the chief public buildings. The principal industries are the manufactures of verdigris, linen, hosiery, and leather. There are distilleries, and dye-, brick-, and tile-works. There is a trade in honey, corn, wine, brandy, oil, salt, and saltpetre. Narbonne was the first formed of the Roman colonies beyond the Alps, but there are few Roman remains.

Narborough, SIR JOHN, an English seaman, was born about the year 1637. Having entered the navy, he became a lieutenant in 1661, and in 1666, for gallantry in the great action with the Dutch, was made a captain. In 1669 he led a voyage of discovery to the South Pacific, but, being hindered by the Spaniards of South America, returned to England. He would have sailed again had not a new Dutch War broken out in 1672. The Duke of York chose Narborough as his flag-captain, and, losing his captain of the fleet at the battle of Solebay, promoted him to the vacant post. Later in the year Narborough was sent with a convoy to the Strait of Gibraltar, and soon after his return he was knighted and appointed rear-admiral of the Red. He cruised with success, and in 1674 was again sent to the Mediterranean. He did not finally return to England until 1679. In the following year he became a Commissioner of the Navy. He died in 1688.

Narcissus, a genus of Amaryllidaceæ, including twenty or thirty beautiful species, natives of Europe and Asia, nearly all of them easily cultivated in England, where, as Shakespeare says, they

“Come before the swallow dares, and take
The winds of March with beauty.”

They are bulbous plants, some having flat, and others round, rush-like leaves, whence the name Jonquil, a corruption of *junci-folius*, “rush-leaved.” Their hollow radical scapes bear either one flower, as in the common daffodil (*N. pseudo-narcissus*), or several, as in *N. Jonquilla* and *N. Tazetta*, the flowers, in either case, having a sheathing membranous spathe.

The perianth is generally some shade of yellow; but in the Poet's or Pheasant's-eye Narcissus it is white. It varies much in the length of its tube and the size and direction of its six segments, and in the size, shape, and colour of its characteristic “coronet” or *corona*, which encloses the six stamens and the style of the inferior three-chambered ovary. The coronet is hardly ever of

the same shade as the perianth. In the white Poet's Narcissus it is yellow and edged with red. This coronet originates apparently by co-radial chorisis from the perianth. Their early spring beauty has made the genus a favourite with all poetic minds. Mahomet wrote, “He that has two loaves, let him sell one and buy a flower of the narcissus; for bread is the food of the body, but narcissus is food for the soul”; and it was of daffodils that Keats wrote, “A thing of beauty is a joy for ever.” Our one lovely British species, the common daffodil (*N. pseudo-narcissus*), is also called the Lent lily.

Narcissus, son of the river-god Cephissus and the nymph Liriope, was renowned for his beauty, and one day, beholding his reflection in a stream, became so enamoured that he could not leave the sight, and pined away in longing. The gods changed him into the flower that bears his name.

Narcotics (Greek *narke*, “a deep sleep”), drugs which produce general anæsthesia and which are employed for the purpose of hulling pain or producing sleep, *e.g.* opium, chloral, bromides, etc.

Narcotine, an alkaloid which occurs together with morphine (q.v.) in the seeds of *Papaveraceæ*, *i.e.* the poppy group of plants. It is hence found in opium, from which source it may be extracted. It forms white, glistening crystals, which melt at 176°. It possesses the formula $C_{22}H_{23}NO_7$, and its constitution has been the subject of much recent chemical research, but as yet is hardly definitely established.

Nardoo, the Australian name for *Marsilia macropus*, one of the Rhizocarpeæ or Hydropteridæ, a small group allied to the club-mosses. They have delicate quatrefoil leaves on slender stalks, and small sporangia containing starchy spores which are used as a bread-stuff. The plant is abundant in swamps in the interior of Australia, where the survivors of the ill-fated Burke and Wills expedition starved on its sorry produce.

Nares, SIR GEORGE STRONG, seaman and Arctic explorer, was born in 1831, entered the navy in 1845, and, as mate, shared, in 1852-54, in the search for Sir John Franklin. After service during the Crimean War he commanded the surveying vessel *Salamander* and the *Challenger* during her long scientific cruise until, in 1875, he was recalled to conduct the Polar expedition of 1875-76. He wintered in lat. 82° 27' N., and one of his sleighing parties penetrated to 83° 86'. On his return he was made a K.C.B., and in 1877 was knighted. In 1878-79 he commanded the *Alert* while engaged in surveying the Pacific; in 1886 he retired, in 1887 became a rear-admiral on the retired list. From 1879 onwards he acted as a professional member of the Harbour Department of the Board of Trade.

Narragansetts, North American aborigines, a branch of the Algonquian family, formerly dominant in the present states of Massachusetts and Rhode Island, where the name still survives in Narragansett Bay. Like the neighbouring and allied Massachusetts, they have long been extinct.



NARCISSUS.

Narses, the eunuch, was a statesman and general who was born at the end of the 4th century B.C. His description shows that he was probably sent to Constantinople as a slave. In any case Justinian promoted him to the office of chamberlain and keeper of the privy purse. In 538 he was at the head of an army sent to aid Belisarius to expel the Goths; but the generals quarrelled, and Narses was recalled. In 552 he was sent to Italy against Totila, whom he defeated; and having captured Rome, he drove out the Goths, and was governor of the country for fifteen years. His exactions aroused discontent, and the complaints against him caused his deposition. He is said to have then invited the Lombards to invade Italy. He lived at Naples, and died at Rome.

Narvaez, RAMON MARIA, DUKE OF VALENCIA (1800-68), a Spanish statesman and general, was born in Andalusia. He served in the army with distinction, and in 1830 under Espartero he pursued and routed Gomez. His popularity led him to enter into politics, and he became the rival of Espartero. In 1838 he took part in an abortive rising of Progressists, and for five years had to stay abroad. Then taking advantage of Espartero's unpopularity he returned to Spain, and at the head of insurgents entered Madrid as a victor in 1843. In the next year he became Prime Minister, and Queen Isabella made him Marshal and Duke of Valencia. In 1846 the government was overthrown, but he was often recalled to power, becoming more and more Conservative till his last Ministry in 1866. For the remaining years of his life he tried to advance the interests of Queen Isabella.

Narwhal (*Monodon*), a genus of toothed whales, of the Dolphin family, with one species (*M. monoceros*), from the Arctic seas of both hemispheres. The adult male possesses a long, spirally-twisted tusk or "horn," really the abnormally developed canine tooth of the left side; the tooth on the right is very rarely developed, though this sometimes occurs. It is rarely present in females, though Scoresby found a female with a tusk over four feet long. The use of these weapons is unknown. The body of a full-grown male may be 14 feet long, and the tusk from 6 feet to 10 feet. The general colour of the young is bluish-grey; older animals are lighter with dark spots. Narwhals are hunted for the oil they yield, and the ivory of their tusks.

Naseby, a village in Northamptonshire, 12 miles N. of Northampton, and celebrated for the defeat which Charles I. here sustained at the hands of Fairfax and Cromwell.

Nash, JOHN (1752-1835), a British architect, was born in London, and articulated at an early age to Sir Robert Taylor. He made many improvements in London, among his works being the laying-out of Regent's Park, and the making of Regent Street. He also designed the United Service Club, Buckingham Palace, the Haymarket Theatre, and the Brighton Pavilion.

Nash, RICHARD, commonly known as "Beau Nash" (1674-1761), was born at Swansea. He was

trained to law, but entered the army, abandoning it later for the Temple, where he pleased King William as Master of the Pageant during a royal visit. In 1704 he became master of ceremonies at Bath Pump Room, and as "King of Bath" governed strictly. For a time, gaming and a tax on the tables made him rich, but he fell on evil times, and, dying, was finally buried by the city.

Nash, THOMAS (1558-1600), an English satirist and dramatist, was born at Lowestoft, and graduated at Cambridge in 1584, but, being expelled for a satire, resided for a time on the Continent. In 1589 he returned to London, and wrote many pamphlets on behalf of the Prelatists against the Puritans. With Marlowe he wrote *Dido*, and in 1592 published *Summer's Last Will and Testament*. He died in poverty.

Nashville, a town in the United States, capital of Davidson county and of the state of Tennessee. It is on the left bank of Cumberland river, the steam traffic on which ends here. The town and suburbs are built on and around limestone heights, and there is a considerable trade.

Nasik, a town of the Bombay Presidency, on the Godaveri, not far from the source, 150 miles N.E. of Bombay, and within four miles of the railway. It is a sacred town, and pilgrimages are made to it. Paper and cotton are manufactured, and there is much brass- and copper-working. Nasik was once a Mahratta capital. The district, of the same name, contains 5,940 square miles.

Naskapi (NASKWAPI), North American Indians of Algonquian stock and speech, widespread in small groups throughout the central and south-west parts of Labrador, in Rupert's Land, about Lake Mistassin and other parts of north-east Canada. They were formerly much more numerous, and are evidently in process of extinction. Some are Roman Catholics, but the majority remain pagans and polygamists, living entirely by hunting and fishing, and cultivating no land. In their language, which is a Cree dialect, *Naskapi* means the "Erect," that is, "Men."

Nasmyth, ALEXANDER (1758-1840), landscape painter, was born in Edinburgh, and came to London, where he studied under the king's painter, Allan Ramsay. He went for a time to Rome, and painted portraits, historical subjects, and landscapes. On his return to Edinburgh he abandoned portraits for landscapes. PATRICK (1787-1831), eldest son of the above, was also a painter, and has been called the "English Hobbema" on account of the minuteness of detail in his pictures. JAMES, the youngest son (1808-1890), mechanical engineer, was famous as the inventor of the steam-hammer (q.v.) and other important machines, and made some valuable astronomical discoveries after his retirement from business.

Nassar, a large branch of the Ghilzae Afghans in the Soleiman Mountains, about the Takht-i-Soleiman; are pure nomads, with no fixed summer or winter camping-grounds, but perpetually wandering about between the uplands and low-lying

valleys according to the vicissitudes of the seasons. They recognise no chiefs except during their warlike or peaceful expeditions, after which each family group resumes its independence and respects that of its neighbours.

Nassau, once an independent duchy, was annexed in 1866 to Prussia, and forms part of the province of Hesse-Nassau. The surface is uneven and fertile, and the district produces the renowned Johannisberger, Rudesheimer, and Hochheimer wines. The capital, Wiesbaden, and Ems, are noted for their mineral springs.

Nassellaria, the third of the four orders into which Haeckel has divided the class Radiolaria (q.v.). The characteristics of the order are the siliceous skeleton and the fact that the pores in this are limited to a pore area (or porochora) at one end of the main axis of the body. The order includes many familiar forms, *e.g.* the helmet-shaped Cystoidea.

Nasturtium (said to be derived from *nasi tortio*, "twisting of the nose," referring to their pungency) is the classical name for cress (q.v.), applied by Linnæus to the genus of Cruciferae (q.v.), of which the water-cress (q.v.) (*N. officinale*) is the best known. In the 16th century, when properties were more considered in the classification of plants than structure, the species of the widely-different, but pungent, genus *Tropæolum*, on their introduction from America, were termed "Indian cresses" or *Nasturtium indicum*, and have ever since retained the name Nasturtium.

Natal, a district in the S.E. of Africa, taking its name from the fact that it was discovered by Vasco di Gama on Christmas Day, 1497. The Portuguese and Dutch made three vain attempts to settle there, but in 1834 an English party settled at Durban during the reign of the Zulu king Chaka. In 1835-37 some Boers settled in the N. The Boers having started a government at Pietermaritzburg, the English Government annexed the country in 1843, and in 1856 it was made a separate colony. Durban is 800 miles from Cape Town. The colony contains 20,460 square miles, with 180 miles of coast, and in its population the natives largely preponderate, while there are many Indian coolies. The Drakenberg mountains are in the N.W., and the land rises in a series of terraces from the sea to them. There are 23 rivers, not navigable, and the scenery is good. The coast region is fertile, and tropical in productions, among these being sugar, coffee, indigo, arrowroot, ginger, tobacco, rice, pepper, cotton, and pineapple. In the midland districts European products are raised, while the highlands form excellent grazing grounds. There are large coalfields and good beds of iron-ore, and forest timber was plentiful. The chief exports are wool, skins, angora hair, gold and sugar. Durban is the only important harbour, and the chief railway is from Durban to the capital Pietermaritzburg, 50 miles inland. The high-lying districts are beneficial to those suffering from chest diseases.

Natatores (Swimmers), in some classifications, an order of birds, containing those which

are partially or entirely web-footed. There are four groups or families: (1) Auks, Penguins, Guillemots, Divers, Grebes; (2) Gulls, Terns, and Petrels; (3) Pelicans, Cormorants, Gannets, Frigate-birds, Tropic-birds, and Darters; (4) Ducks, Geese, and Flamingoes.

Natchez, a renowned North American nation, formerly powerful in the lower Mississippi basin above the Delta, where is now the city of Natchez; two divisions, *Na'htchi* and *Taensa*, extinct all but four *Na'htchi*, living (1892) with the Creeks of Indian Territory and a few in the Cherokee Hills. Most of the Natchez were destroyed by the French in 1730, when the survivors took refuge amongst the Chickasaws and Upper Creeks. The Natchez was a stock language fundamentally distinct from all others; but much doubt prevails regarding the affinities of the *Taensa*, the grammar of which, with vocabulary and texts, published by J. D. Haumonté in 1882, is believed, on internal evidence, to be a fraud. (D. G. Brinton, *American Antiquarian*, March 1885, pp. 109-14.)

National Debt, the sum which the government of a country has borrowed for public purposes, and the interest on which is paid by means of taxation. From an early period sovereigns have had recourse to loans as a means of meeting current expenses, but they were always required to give some security; in the Middle Ages, for example, they frequently pawned the crown jewels. Under these circumstances public debts were neither very large in themselves nor did they accumulate to any considerable degree. In England it was the desirability of having a fixed centre of wealth on which to draw for public purposes that led to the formation of the Bank of England (q.v.) in 1694. As regards the *origin* of national debts, it may be stated broadly that war has always caused the chief drain on the resources of a country. In England, for example, £600,000,000 were added to the national debt during the wars with Napoleon. With reference to the *character* of public debts, it is to be remarked that they differ in some particulars from those of private individuals. The claim of a citizen who has debts owing to him from a foreign government upon the protection of the state is generally recognised, and the discharge of obligations undertaken in connection with them is sometimes enforced by means of active hostilities, as in the intervention of France and other European powers in Mexico in 1861. It is a generally-admitted principle that debts should be repaid in the present value of the national currency, since the probability of a rise or fall in the value of stock was a consideration which decided the original terms of the loan. The *advisability of paying off the national debt* is a question regarding which very diverse views have been held by economists and statesmen. Amongst the arguments brought forward against repayment, it is maintained that the national wealth is not diminished by the transfer of a certain portion from one class of the community to another which the payment of the interest involves; that the existence of the debt prevents capital from being sent abroad; and that,

even if repayment is desirable, it should be postponed till a further increase in the resources of the country lessens the strain which the operation would cause. These and other contentions are either radically unsound, or their cogency is very much modified by other considerations, and most economists now hold that the extinction of the debt is desirable if it can be effected without having recourse to burdensome and injurious taxation. The national debt of Great Britain, which was £243,063,145 in 1784, was reduced from £861,039,049 in 1815 to £677,679,571 in 1892. The following were the debts of some of the chief European countries and British colonies in 1891—

France	-	-	-	£1,288,500,000
German Empire	-	-	-	62,557,204
Prussia	-	-	-	237,208,116
Austria-Hungary	-	-	-	494,828,000
Italy (1890)	-	-	-	562,200,000
Russia (1888)	-	-	-	746,220,720
Turkey (1890)	-	-	-	180,000,000
India	-	-	-	72,446,450
Canada	-	-	-	48,864,869
New South Wales (1892)	-	-	-	50,995,433
New Zealand (1892)	-	-	-	38,713,068

In 1892 the total debt of the United States was \$1,628,955,122, of which \$729,020,277 is covered by the cash in the Treasury.

National Gallery, the most important public collection of pictures in Great Britain, containing numerous and valuable examples both of the old masters of various schools and of many eminent modern painters. The first purchase was made in 1824, when £57,000 was expended; and the number of pictures is constantly increased through the liberal grant made annually by Parliament as well as the munificence of private individuals; at present they amount to over 1,280. The building in Trafalgar Square, London, in which the collection is now housed, was completed in 1838, and has been several times enlarged.

National Guard. The French National Guard was organised in the first year of the Revolution (July, 1789). It was intended primarily for the defence of the capital, and was placed under the control not of the Crown, but of the municipality of Paris. Bodies of this kind already existed in some of the provincial towns. The Paris guard numbered 48,000 citizens at the outset, and soon afterwards the total number engaged in the defence of the kingdom was nearly 300,000. The National Guard was finally abolished in 1870.

National Lifeboat Institution, THE ROYAL, founded in 1824, is an association for the providing and maintaining of lifeboats and life-saving appliances on the coasts of Great Britain and Ireland, and for rewarding gallant services in connection with the saving of life at sea. It supports nearly 300 lifeboats, and has been instrumental in saving nearly 35,000 lives. Since 1854, when the self-righting lifeboats were introduced, those vessels have been launched about 6,500 times. A sum of £3,000 is sufficient to provide and endow one of the most modern boats.

Native Rabbit (*Perameles lagotis*), the Rabbit-Bandicoot, from Western Australia, sometimes made the type of a genus, *Macrotis*.

Natron, a carbonate of soda which occurs as a mineral deposit in various localities in Egypt, Siberia, Mexico, and other parts. It is also known under the names of *Trona* and *Urao*.

Naturalisation signifies anyone becoming the subject of a state to which theretofore he was an alien. Naturalisation can be effected either by Act of Parliament or by the certificate of a Secretary of State. According to the first method, an alien is put in exactly the same state as if he had been born in the kingdom. It has therefore a retrospective effect, in which it differs from mere denization; and, consequently, if a man was naturalised by Act of Parliament, his son born before might inherit land in the realm. In regard to naturalisation by certificate of Secretary of State, it is a modern method, introduced by a statute passed in the year 1844 in order to enable foreigners coming to reside and settle in the United Kingdom to obtain the advantages of naturalisation in a less expensive and tedious way than by procuring a private Act. This statute has, indeed, been repealed, but by the Acts now existing on the subject, passed in the years 1870-72, an alien who has resided in the United Kingdom (or has been in the service of the Crown) for not less than five years, and intends when naturalised either to reside in the United Kingdom or to serve under the Crown, is enabled to apply for a certificate of naturalisation to one of the Secretaries of State, who may, after receiving the necessary evidence in support of the application, issue, if he shall so think fit, to the applicant a certificate accordingly, whereupon, and upon his taking the oath of allegiance, the alien shall, in the United Kingdom, be entitled to all political and other rights, powers, and privileges, and be subject to all the obligations to which a natural-born British subject is entitled or subject in the United Kingdom.

Natural Philosophy is a science which, in its evident sense, includes all scientific knowledge which is based upon natural law. A mere record of phenomena, however interesting, would not be included in natural philosophy; but directly an explanation of these phenomena can be given, directly we can measure the effects of any given cause, then their study rises to the level of philosophy. It is usual to limit the term natural philosophy to that branch of science which deals with the behaviour of bodies when they do not undergo any change in themselves. Chemistry and botany are hence excluded, while astronomy, although really a branch of natural philosophy, has become so vast a subject that it, too, is excluded and left to form a separate science. Natural philosophy is thus limited to the various branches of physics (q.v.).

Natural Selection. [DARWINISM.]

Nature-Worship, a form of religion in which physical phenomena are worshipped as gods, or as the representatives of gods. Nature-worship reached its highest development in classic times.

Naucratis, an ancient city of Egypt, in the Nile Delta. The site, 47 miles S.E. of Alexandria, is now close to the village Debireh. It was discovered by Flinders Petrie in 1884, and he published an account of the ruined temples, etc., of Naucratis (1886). The Greeks were allowed to trade here, and the city was a centre of the worship of Aphrodite. Some good pottery has been found.

Naumachia (Greek "sea-fight"), in ancient Rome, was a public spectacle, consisting of the representation of a naval battle, in which gladiators fought as they did in the amphitheatre. The first naumachia took place on a sheet of water in the Campus Martius, made for the purpose by Julius Cæsar (46 B.C.).

Naumberg, a Prussian town in the province of Saxony, and 18 miles S.W. of Merseburg. It is prettily situate among the hills in the valley of the Saale, and is surrounded by gardens and vineyards. There is a good Protestant cathedral, rich in specimens of old German art, a Roman Catholic cathedral, a castle (now used as public offices), and a town-hall. The chief manufactures are of carriages, combs, cards, cloth, hosiery, leather, and a trade is carried on in wine and wood.

Nauplius, the name of one of the principal of larval forms of Crustacea. Unlike the adults, the body of the larva is not divided into a series of divisions or segments; it has, moreover, only three pairs of appendages, which correspond to the two pairs of feelers or antennæ and the mandibles or jaws. Another difference from the adult is the possession of only a single eye in the middle line of the head instead of a pair placed one on either side. The name was given to this larva under the impression that it was a distinct animal, before its life-history was discovered. This form of larva is typical of the subdivision of the Crustacea known as the Entomostraca (q.v.); it occurs, however, in two members of the other group—the Malacostraca (q.v.), viz. the genera *Euphausia* and *Penæus*, while in a third genus, *Lucifer*, there is an allied form known as the Meta-Nauplius, which differs from the nauplius by the presence of two additional pairs of limbs.

Nausea, the term applied to the feeling of discomfort which precedes actual vomiting (q.v.).

Nautical Almanac, an almanac issued under authority of the Board of Admiralty, under the direction of the "Nautical Almanac Office." It contains lists of the astronomical phenomena of the year, and the elements requisite for finding the longitude at sea. It first appeared in 1767 under the editorship of Dr. Maskelyne, then Astronomer-Royal, who superintended its preparation for forty years. The equivalent French publication is called *La Connaissance des Temps*.

Nautiloidea, the sub-order of Tetra-branchiata Cephalopoda (q.v.), of which *Nautilus* is the typical and only living member. It differs from the other sub-order Ammonoidea (q.v.) in that the sutures or lines that mark the division of the separate body-chambers are usually simpler and less folded than

in the latter group; the siphuncle, moreover, passes through the centre of the septa and is protected by a back growth from this, forming a collar.

In addition to the living *Nautilus*, the order includes a large number of extinct forms, and dates from the Upper Cambrian period.

Nautilus, the one living genus of Cephalopoda belonging to the sub-class Tetrabranchiata, and the type of the order Nautiloidea (q.v.). The animal is included in a strong coiled shell composed of many different chambers; these are cut off from one another by transverse calcareous plates, or septa, which are curved and have the convex surface directed forwards. The traces of these septa on the external wall of the shell are gently



THE PAPER NAUTILUS.

wavy or straight, and not complicated by a great series of foldings as in the Ammonites. The septa are perforated in the centre by a membranous tube known as the siphuncle, which is protected as it passes through the septa by a number of backwardly directed calcareous processes known as the collars. Though the shells of the *Nautilus* are extremely common, the animal is rare. Its anatomy is of great interest, as the genus is the only known living member of the order. The body is internal, and occupies only the last body-chamber of the shell. It differs from all the other living Cephalopods [CUTTLEFISH] by the absence of an ink-bag, of auricles to the heart, and of the expansions at the base of the gills known as "branchial hearts." The foot is divided into lobes arranged around the mouth; each of these lobes corresponds to one of the arms of the Octopus (q.v.); the suckers on the arms of other Cephalopods are here represented by a series of tentacles, of which there are over sixty. The funnel, by the ejection of water from which the animal can swim backwards, consists only of a loose slit, and not a closed jet, as in the other Cephalopoda. The eyes are extremely simple, and consist only of a pair of simple pits. There are two pairs of gills (whence the name Tetrabranchiata). As there are also two pairs of nephridia, it is thought that this may indicate a trace of ancestral segmentation. The genus is marine, and occurs widely distributed through tropical seas. As at present defined, it dates only from the Liassic period.

Navarino, THE BATTLE OF, was led up to by the refusal of the Ottoman Government to accede to the demand of the Powers that an armistice should be granted to the Greek insurgents. A combined British, French, and Russian force, under Sir Edward Codrington, enforced the demand in October, 1827, by entering the Bay of Navarino where the Turco-Egyptian fleet lay at anchor and by destroying it, though not until the enemy had begun the action.

Navarre, a Spanish province between Aragon, Old Castile, and Biscay, having France on the N., and containing 2,449 square miles. It lies below the west slopes of the Pyrenees, and many streams flow thence to join its rivers, the Ebro and Bidassoa. The climate is temperate and healthy. Timber is grown on the uplands, while the lowlands produce wheat, maize, wine, oil, flax, and hemp. Iron, copper, and lead are found. The Basque language prevails in the north. Half of Old Navarre came to France through Henri IV.

Navies. The navies of the Powers, at the close of the year 1893, were composed of the following ships, besides transports, yachts, store-ships, harbour crafts, surveying vessels, and hulks:—

and uncertainty. The Phœnicians were the most successful and venturesome of early navigators, and there is good reason to believe that long before the Christian era they or their pupils visited not only Britain, but also the eastern and western coasts of Africa as far as points lying considerably to the southward of the equator. The subject is too extensive a one to be entered upon in detail here; but the inquirer may profitably refer for the history of the art to Locke's *History of Navigation*, and for information as to the practice of it to Norie's *Epitome of Practical Navigation* (1806), Raper's *Practice of Navigation and Nautical Astronomy* (1843), and the modern works, Harbord's *Glossary of Navigation*, Morris's *Elementary Navigation*, Lecky's *Wrinkles in Navigation*,

	Ironclad Battleships.			Coast-defence Ironclads.	Armoured Cruisers.	Cruisers Protected or Unarmoured.			Sloops and Corvettes.	Gunboats.	Torpedo Gunvessels.	Torpedo-boats.		
	1st Cl.	2nd Cl.	3rd Cl.			1st Cl.	2nd Cl.	3rd Cl.				1st Cl.	2nd Cl.	3rd Cl.
Argentina ...	—	—	3	2	—	—	2	1	—	7	1	8	4	14
Austria ...	—	—	4	2	—	—	3	6	8	10	6	24	31	8
Brazil ...	—	2	1	2	—	—	2	4	4	23	—	8	5	12
Chili ...	—	1	2	—	—	—	2	2	2	8	2	1	8	4
China ...	—	2	4	1	—	—	3	16	3	31	1	3	27	13
Denmark ...	—	—	1	9	—	—	2	5	1	15	—	7	5	11
France ...	16	15	6	15	18	4	34	28	24	53	13	110	121	15
Germany ...	4	7	5	22	—	1	14	8	8	12	10	133	4	16
Greece ...	—	3	2	—	—	—	—	2	2	15	—	6	11	13
Hayti ...	—	—	—	—	—	—	—	1	2	2	1	—	—	—
Holland ...	—	2	2	22	—	—	6	6	21	47	4	15	5	23
Italy ...	12	—	5	4	—	4	18	10	—	26	19	99	14	19
Japan ...	—	—	1	1	3	—	8	9	6	6	4	4	37	—
Mexico ...	—	—	—	—	—	—	—	1	—	4	—	5	—	—
Norway ...	—	—	—	4	—	—	—	—	4	31	—	—	8	2
Peru ...	—	—	—	—	—	—	—	1	1	1	—	—	—	—
Portugal ...	—	—	1	—	—	—	—	—	6	22	—	8	1	2
Roumania ...	—	—	—	—	—	—	—	1	—	9	—	6	—	2
Russia ...	11	5	3	24	10	—	3	17	—	17	6	63	2	107
Spain ...	1	—	3	2	8	3	7	10	2	51	13	36	2	9
Sweden ...	—	—	3	13	—	—	—	1	3	14	—	3	15	7
Turkey ...	1	2	12	4	—	—	2	3	3	21	6	24	7	—
United States ...	3	—	1	20	5	2	11	8	14	4	—	2	1	—
United Kingdom ...	22	12	11	16	19	13	49	52	25	96	31	97	25	83
Uruguay ...	—	—	—	—	—	—	—	—	—	4	—	—	—	—

The officers and men available for sea-service in the navies of the chief maritime Powers at the same period were: United Kingdom, 70,500 including 15,000 Royal Marines; France, 44,800 (excluding the *Infanterie* and *Artilerie de la Marine*, 31,000 strong); Russia, 40,000; Italy, 22,500; Germany, 18,000; United States, 12,000; Austria-Hungary, 13,300. The estimated annual naval expenditure at the same period was: in the United Kingdom £14,240,000; in France £10,224,000; in Russia £5,543,000; in Italy £4,113,000; in Germany £5,212,000; and in the United States £4,894,000.

Navigation is the art of directing the course of a ship at sea and finding her position by observation of the heavenly bodies, the indications of the compass, calculation of distances traversed, and the use of charts. It is an art of great antiquity, but until the use of the compass became general it was necessarily pursued with difficulty

Martin's *Navigation and Nautical Astronomy*, and Jeans's *Nautical Astronomy and Navigation*. The works of Norie and Raper are standard ones, and new editions of them have often been published.

Navigation Acts, THE, were laws passed at various times for regulating the conditions under which foreign ships might trade with Great Britain and for regulating the privileges of British shipping. Under Henry VIII. and Elizabeth foreign ships were excluded from our coasting trade. Cromwell excluded all foreign unlicensed ships from trade with America; and in 1651 the Navigation Act forbade the importation to England of goods unless by English ships or by ships of the producing countries. The measure provoked the Dutch, who then did much of the carrying trade of the world, to make war, but they did not succeed in procuring its repeal. Another Act of 1660 provided for the exportation of all colonial products in English



NAVY.

bottoms. One of 1663 forbade the colonies to receive goods except by English vessels. The Navigation Act of 1672 reaffirmed and enlarged that of 1651, and completed the ruin of Dutch trade: but the legislation on these lines had also the effect of ultimately leading to the rebellion of the American colonies. After the rebellion the United States became a foreign nation, and American retaliation led to the war of 1812, upon the conclusion of which, by the Treaty of Ghent, discriminating duties were abolished. Thenceforward the legislation of two hundred and fifty years began to be slowly undone. The Reciprocity of Duties Act was passed in 1823; the Navigation Act was in 1826 repealed in favour of a much more liberal measure; and finally in 1854 even the coasting trade of England was thrown open to all the world.

Navy, MERCHANT. At an early period of her history England possessed no other sea-going ships than those which belonged to the merchants. Some of these were from time to time hired by the Government for service as vessels of war, but the distinction between the merchant navy and the royal navy may be said not to have begun to develop in a permanent form until about the reign of Henry VII., and for at least a century afterwards it was not very strictly defined. Of the ships which served against the Spanish Armada in 1588 only 34 belonged to the Government out of a total of 197 sail employed; and up to the close of the seventeenth century it was a not uncommon thing for merchant officers to be given commands in the royal navy and for the naval officers to do duty in the merchant service. The largest merchant vessels of Elizabeth's reign appear to have been of not more than 400 tons' burthen. Thereafter, during two hundred years, they grew little in size, though they vastly increased in numbers. After the establishment of the East India Company the ships of that powerful corporation were, for a long period, the largest merchant vessels that sailed from English ports; but up to 1770 the biggest English East Indiaman afloat was of no more than 500 tons. Thenceforward progress was more rapid, and before the conclusion of the century ships of as much as 1,200 tons became comparatively common. The long wars, which began in 1793 and which lasted with very little intermission until 1815, found the English merchant navy in a more flourishing condition. It then included about 16,000 sail, averaging, however, not more than 130 tons. After a brief experience of the effects of war, most people appear to have believed that long-continued hostilities could not fail to be fatal to British sea-borne commerce; but, as a matter of fact, the number of losses of ships by capture at no period very greatly exceeded the number of losses of ships by the ordinary and inevitable risks of the sea; and, when the country had once grasped this fact, its merchant navy, instead of being extinguished or even being diminished, began to advance by leaps and bounds. Its development was further assisted by the commercial policy of France, and

especially by that of Napoleon, which in time had the effect of handing over the greater part of the carrying trade of the world to Great Britain and the United States. In 1795 the British mercantile marine included 16,728 vessels; in 1800, 17,885; in 1805, 22,051; and in 1810, 23,703; and in size as well as in numbers the ships had increased. In 1792, the last year of the peace, the value of British exports and imports was but £44,565,000; in 1796 it grew to £53,706,000; and in 1800 to £73,723,000. Since then it has never, for many years in succession, ceased to grow; but for nearly half a century after the conclusion of the war the mercantile supremacy of Great Britain at sea was seriously threatened by the energetic action of the United States. The rivalry was at length checked by the effects of the Civil War in America; and from the day of the opening of that conflict Great Britain has stood alone. The relative rate of progress of the mercantile marines of the chief commercial Powers is best shown by the following table of the amount of the sea-going tonnage belonging to the various countries in the decennial periods from 1850 onwards and for 1892. To save space, the three last figures are in every case omitted, so that the sums must be read as expressing "thousands of tons":—

	1850.	1860.	1870.	1880.	1892.
British Empire ...	4,232	5,710	7,149	8,447	12,455
United States ...	1,585	2,546	1,516	1,352	1,926
France ...	688	996	1,072	919	1,057
German Empire ...			982	1,182	1,703
Norway ...	298	558	1,022	1,511	1,681
Italy ...			1,012	999	818
Sweden ...			346	542	498
Holland ...	292	433	389	328	435
Austria-Hungary ...			329	290	273
Denmark ...			178	249	310

The altogether exceptional position of the British Empire as a commercial sea-power is further and more strikingly shown by means of the appended statistical comparison, which has been compiled from *Lloyd's Register of Shipping*. The figures, which are here given in full, are those for the year 1892:—

	THE BRITISH EMPIRE.		THE REST OF THE WORLD.	
	No.	Tonnage.	No.	Tonnage.
Steamers.				
Wood ...	400	110,501	598	252,814
Composite ...	15	5,330	133	36,099
Iron ...	4,277	4,798,830	3,254	3,260,018
Steel ...	2,189	4,202,222	1,327	1,896,189
Total ...	6,881	9,116,883	5,312	5,445,120
Sailing Ships.				
Wood ...	3,225	1,062,097	14,118	5,137,656
Composite ...	66	44,612	59	46,542
Iron ...	1,382	1,553,655	425	371,260
Steel ...	411	678,440	187	238,243
Total ...	5,084	3,338,804	14,789	5,793,701
Grand Total	11,965	12,455,687	20,101	11,238,821

Of the ships classed above as British, 6,035 steamers and 3,225 sailing vessels belonged to the United Kingdom, and 846 steamers and 1,859 sailing vessels to the colonies. Of iron and steel vessels it may be observed that out of a grand total of 13,452, as many as 8,259 belonged to the British Empire.

The British Mercantile Marine, under Acts of 1854 and 1867, was entrusted to the superintendence of the Board of Trade. Numerous special Acts have been passed in the interests of seamen, passengers, freighters, and owners. British merchant vessels are only entitled to fly the Red Ensign, unless they be hired for naval purposes, or unless they be commanded by officers of the Royal Naval Reserve, carry at least ten members of the crew who belong to the Royal Naval Reserve, and have the necessary warrant from the Admiralty. In such a case the Blue Ensign may be worn.

Navy, THE ROYAL. The origin of the royal navy of this country may, with an approach to truth, be said to be lost in the mists of antiquity. In early days the sovereigns mainly relied for the defence of the coasts and of the narrow seas upon the right which they possessed of calling upon a certain part of the population not only to serve at sea, but also to supply ships. Many kings, however, also had ships of their own, and these may be said to have formed a royal navy. Not until Henry VIII.'s time was there perhaps a royal, in the sense of a national, navy. Henry organised one, and although he did not create a permanent body of officers, his constitution of the navy was not, in many other respects, different from that which is in force to-day. Sea officers, as a specially trained class, appeared under the Commonwealth, and under James II., who was himself a seaman of ability, became the only class generally capable of holding naval command. James also introduced the system of half-pay, and effected numerous further improvements. From a very early date until 1649, and again from 1660 to 1673, from 1684 to 1689, from 1702 to 1708, and in 1827-28, the navy was governed by a Lord High Admiral. The discipline of the navy is provided for by the Naval Discipline Act, or "Articles of War," a measure which, with usually no alterations, is renewed annually; and by the "Queen's Regulations and Admiralty Instructions," which are established by Order in Council, and very frequently added to or modified. Offences which are sufficiently serious are dealt with and punished by a court-martial, sitting under and punishing in accordance with, these provisions. Naval officers are either military or civil. The former, in order of rank beginning with the highest, are: admirals of the fleet; vice-admirals; rear-admirals; commodores (*i.e.* captains so appointed); captains; staff-captains; commanders; staff-commanders; lieutenants; navigating-lieutenants; sub-lieutenants; navigating sub-lieutenants; chief warrant officers (chief gunners, chief boatswain); warrant officers (gunners and boatswains); mid-shipmen, and naval cadets. The civil officers, in similar order, are: inspectors-general of hospitals

and fleets; secretaries to admirals of the fleet; paymasters-in-chief; chief inspectors of machinery; deputy-inspectors of hospitals and fleets; senior inspectors of machinery; senior secretaries to commanders-in-chief; junior inspectors of machinery; junior secretaries to commanders-in-chief; fleet surgeons; fleet paymasters; fleet engineers; secretaries to junior flag-officers; staff-surgeons; staff-paymasters; senior naval instructors; staff-engineers; paymasters; chief engineers; secretaries to commodores of the second class; junior naval instructors; surgeons; senior assistant-paymasters; senior engineers; medium assistant-paymasters; junior engineers; junior assistant-paymasters; assistant-engineers; chief carpenters; carpenters; head schoolmasters; clerks; assistant-clerks; and engineer students. Chaplains hold no naval rank, "but retain when afloat the position to which their office would entitle them on shore." The navy, it may here be noted, is senior to the army, and takes precedence of it. The expression "Army and Navy" is therefore incorrect, while "Naval and Military" is quite as it should be. In cases in which officers are otherwise of equal relative rank, a naval officer consequently precedes, or even takes command of, an army one. In 1805 the navy included 175 ships of the line and 246 frigates. With these may be compared the 80 ironclads and 114 cruisers of the British Empire in 1893. The modern vessels, it must not be forgotten, are, upon an average, of five times the tonnage of the old, and of ten times the costliness. Nelson's *Victory* in 1765 cost about £17 a ton to build; the *Royal Sovereign* of 1891 cost nearly £60 a ton for hull and machinery alone; and all her expensive guns and fittings had still to be paid for, and, as in point of numbers, so also in point of size did ships increase even before Nelson's day. The largest war-ship of Elizabeth's time was of not more than 1,000 tons burthen. In 1667 a 100-gun first-rate measured 1,500 tons; in 1719, 1,870 tons; in 1745, 2,000 tons; in 1780, 2,200 tons; and one of the last 100-gun ships constructed was of 3,727 tons burthen, or 5,724 tons displacement; but this is, of course, little in comparison with the *Magnificent's* displacement of 14,900 tons. A great stimulus to increased size was afforded by the introduction of steam, the screw, and iron as a building material; and it was renewed when, after the Crimean War, the principle of armouring battleships was adopted, and the long rivalry between ever thickening armour and ever weightier guns began. Steel has since become the usual building material, and the use of sail-power, even as an auxiliary, has been almost entirely dispensed with in modern ships of war. The developments of recent years have to a very large extent altered the nature of the qualifications which have to be looked for in the good sea-officer, who must now be not merely the navigator, the mariner, and the brave man whom he was required to be in Nelson's day, but also an electrician, a chemist, an engineer, and a man of science generally. Whether the British service can fit in with the new conditions as well as it did with the old has yet to be proved by the sad test of a great war.

Navy Board, THE. Upon the restoration of Charles II., his Majesty appointed a Treasurer, Controller, Surveyor, and Clerk of the Navy, who were styled Principal Officers. To them were added a few months later three Commissioners "to assist the said Principal Officers in the management of the affairs of the Navy." These seven individuals formed the Navy Board. The number of members was at various subsequent periods modified; but the Navy Board continued to manage the civil affairs of the navy until 1832, when it was abolished, and its work put under direct control of the Board of Admiralty. The Navy Board met at the Navy Office, which in the earlier days of its existence was on Tower Hill and in the later at Somerset House.

Naxos, the largest of the Cyclades, is in the Greek archipelago, east of Paros. It is a beautiful mountainous island, 18 miles long by 12 broad, and contains 170 square miles. There is much granite, marble, and serpentine, and emery is exported. The chief productions are fruit, wine, oil, wax, honey, and cheese. The island was settled by Ionians from Athens, and was famous for its wine and its part in the history of Dionysos and Ariadne. The capital, also Naxos, has a small harbour.

Nazareth, a town of Palestine, formerly in Galilee, now in the pashalic of Acre, and 65 miles N. of Jerusalem. Its interest chiefly lies in its being the place where Christ spent His childhood and boyhood. There is a Franciscan church, a mosque, a Protestant church and schools, a house for guests, and an orphanage for Arab girls.

Neagh, LOUGH, the largest lake of the United Kingdom, is in North Ireland, and has Antrim on the N. and E., Armagh on the S., and Tyrone and Londonderry on the W. There are few islands, the shores are swampy, and the lough receives the Bann, Blackwater, Maine, and Bullinderry, while the northern outlet communicates with the Lower Bann. Owing to its slight elevation, the lake, which is 17 miles long, 11 wide, and contains 153 square miles, might easily be drained.

Neale, JOHN MASON (1818-1866), a noted English hymnologist, was educated at Trinity College, Cambridge. In 1842 he was ordained to a cure at Crawley, and in 1845 was appointed Warden of Sackville College, East Grinstead. In 1856 he founded the Sisterhood of St. Margaret. He wrote a *History of the Eastern Church, Mediæval Preachers, History of the Jansenist Church of Holland*, and many interesting short stories and legends; but it is for his hymns, original and translated, that he is chiefly known, among them being *The day is past and over* and *Jerusalem the golden*.

Neander, JOHN (1789-1850), a German theologian, was born of Jewish parents at Göttingen, where, after becoming a Christian, he studied. In 1812 he was appointed professor of theology at Heidelberg, and the same year to a similar post at the Berlin University. He was a great authority upon historical theology, and was much loved by his pupils. His many works, several of which have

been translated into English, were collected in one edition in 1862.

Nearchus, a captain of Alexander the Great, conducted a fleet from India to the Persian Gulf, and as a reward received a garland and one of Alexander's wives. He wrote an account of his voyage, *Paraplous*—a work which has been largely borrowed from.

Nebraska, one of the states of America, having Dakota on the N., Wyoming and Colorado on the W., Kansas on the S., and separated from Iowa and Missouri by the Missouri river. Its area is 76,855 square miles, most of it wild and uncultivated. On the W. the Rocky Mountains form the Atlantic and Pacific watershed. Its chief rivers are the Missouri, the North and South Platte, and a fork of the Kansas. The centre is part of the Great American Desert, but in the east part are extensive prairies. The climate is good, and there are warm summers. The rich soil produces corn, potatoes, tobacco, hay, and beet. There is salt and coal. The opening of the Union Pacific Railway has helped to develop the state. Bears and other wild animals are numerous. Nebraska became a state in 1867. Capital, Lincoln; largest town, Omaha.

Nebulæ are bright patches seen in the sky, consisting either of far-distant stars or of matter in a less condensed state. The number of nebulae known before Sir W. Herschell's time was only about 100, but by using a better telescope he increased the number to about 2,000. The great improvement in telescopes has enabled more and more of these nebulae to be resolved into clusters of stars, and it is supposed that, if the power of telescopes could be increased to any extent, all nebulae could be so resolved. Nebulae vary greatly in form and appearance; some are clearly clusters of stars, others are perfectly hazy. A round or oval form is sometimes exhibited, with a gradual condensation towards the centre, and a number of stars standing in the centre of a nebulous haze can be observed. Observations on nebulae caused Kant and Laplace to suggest a theory—now known as the *nebular theory*—as to the formation of worlds. They considered that the solar system, for example, originally existed as uncondensed nebulous matter. This gradually condensed towards the centre, forming the nucleus of the sun, and later the outer parts separated into distinct parts, each part condensing into a planet. The different forms of nebulae observed in the heavens were then supposed to be systems in different stages of development. Although instruments, such as Lord Rosse's telescope, have shown that so many nebulae can be resolved into star clusters, yet, on the other hand, the spectroscope has shown us that many nebulae do really consist of uncondensed matter.

Nebular Hypothesis. [NEBULÆ.]

Neck. In the middle line of the front of the neck just beneath the skin is the cartilaginous framework of the larynx, the prominent thyroid cartilage being readily distinguishable in that situation. Just above the upper margin of this cartilage is situated the hyoid bone. The prominent

muscles which stand out on either side when the head is turned to the right or left are the sterno-mastoids. Just within the inner borders of these muscles the pulsation of the carotid artery can be distinctly felt; this vessel is accompanied in its course by the internal jugular vein and the pneumogastric nerve; the external jugular vein lies more superficially, and can be distinctly seen as a blue line beneath the skin in the neck of a thin subject. The thyroid gland, the lobes of which lie on either side of the wings of the thyroid cartilage, is not, as a rule, a prominent object, unless enlarged by disease, in which case it produces the disfigurement associated with goitrous affection. A stiff neck is commonly due to painful affection of the muscles of the neck, mainly the sterno-mastoids; in rare instances what is described as stiff-neck may be due to disease of deeper-lying structures.

Neckar, a large tributary of the Rhine, rises near Schwennenburg, in the Black Forest, and after a winding course of 250 miles flows into the Rhine at Mannheim, being navigable for the lower half of its length. On its banks are Tübingen, Heilbronn, and Heidelberg. The district around produces fair wine, and is famous in legendary lore.

Necker, JACQUES (1732-1804), French financier, was born at Geneva, and became a banker's clerk at Paris at the age of fifteen, and in 1762 founded the London and Paris Bank of Thellusson and Necker. He soon after became a syndic of the French East India Company, and minister for the republic of Geneva. In 1764 he married Suzanne Curchod, an old love of Gibbon's, and the *salon* of Mme. Necker became famous in Paris. After writing a Protectionist essay on *Commerce des Grains*, he became Director of the Treasury in 1776, and Director-General of Finance the next year. He tried to do good to the country, and inaugurated a system of annuities and a *mont de piété*, while he wished to put the assessment of taxes in the hands of provincial assemblies. This project caused his dismissal, the pretext being a *compte-rendu* which he brought out in 1781. He retired to Geneva, but returned to France, and was reappointed to his former office in 1788. His last public measure was the issue of assignats, and in 1790 he retired finally to Geneva.

Necromancy, the art or practice of divination (q.v.) by calling up the spirits of the dead that they may answer questions put to them (*cf.* Deut. xviii. 11; 1 Sam. xxviii. 7-25). The so-called materialisation of the departed at spiritualistic *séances* is a form of necromancy. Late in the Middle Ages the term was applied to magic generally from an erroneous derivation.

Necrophorus, the genus of Coleoptera including the Burying Beetles; it is so called because it lays its eggs in a ball of dung and buries this in the ground. The genus includes many of the largest of the section of beetles known as the Necrophaga.

Necrosis, the death of a portion of bone due to inflammation with stoppage of blood supply, or to injury. If a superficially lying portion of the

bone dies and becomes separated from the living bone beneath, it is said to exfoliate. In some instances the dead portion becomes enclosed in new bony growth, so that the dead piece (*sequestrum*, as it is called) lies in a cavity of living osseous tissue. In some cases almost the whole of one of the long bones may become necrosed. A peculiar form of necrosis, now rarely seen, is that which affects the lower jaw in those who are engaged in working in phosphorus. It was formerly common among the makers of lucifer-matches. The treatment of necrosis consists in supporting the strength of the patient during such time as is occupied in the separation of the dead from the living bone. In some cases the operation known as sequestromy is necessary to affect the removal of the sequestrum. In those instances where a large portion of bone is necrosed, and where high fever is present, and a septic condition is set up, amputation may be deemed necessary.

Nectar, in Greek mythology, was the drink of the Olympian gods. It conferred immortality, and this is perhaps the meaning of the name.

Nectary, any part of the flower which secretes the saccharine exudation, designed to attract insects, known as *nectar*. The term is physiological, nectaries being formed in different cases from very various parts; but their position and form are always related to insect-pollination. In all cases, moreover, the nectary seems to consist of a group of rather large thin-walled cells extending to the surface of the organ. In the Labiatae (q.v.), the heath tribe, the oranges, and other cases, the nectary is a ring-shaped cushion, below the ovary, produced from the floral axis. In Cruciferae (q.v.) it is represented by four or six roundish glandular outgrowths from the axis, between the filaments. In Umbelliferae (q.v.) and Compositae (q.v.) it is at the base of the style, above the inferior ovary. In the Crown Imperial (*Fritillaria imperialis*) there are conspicuous white hollows, secreting nectar, at the base of each perianth-leaf. The small scales at the base of the petals of the buttercup lead by numerous transitional types to the tubular green petals of *Helleborus*, the spurred petals of the Columbine and curious hammer-headed hollow petals of the monkshood. In the rhubarbs the base of the filament of the stamen is the secreting organ; whilst in the order Gesneraceae a whole stamen is aborted into a nectary. The secreted nectar is sometimes, as in *Salvia*, held up by a circlet of hairs, or may collect at the bottom of the flower, retained by the perianth leaves; but in other cases special hollow receptacles known as *spurs* (q.v.) are developed by either the calyx or the corolla. These may either be themselves secretory, as in orchids, or may merely receive nectar secreted by other organs.

Needle-Nosed Flea (*Anthocoris nemorum*, Fabr.), a small black bug which lives on hop plants. It is generally supposed to do great damage to the hops, but it probably really attacks the larger insects which are the cause of the damage.

Needles. The origin of the sewing-needle dates back to a prehistoric era. Needles were

originally made of bone or ivory, as is still the case amongst savage races. In civilised regions these materials were discarded on the discovery of bronze, for which steel was afterwards substituted. Many needles of bronze and bone with eyes have been found on the sites of the ancient European lake-dwellings and in caves. The manufacture of steel needles originated at Nuremberg in the latter part of the 14th century, and was introduced into England early in the reign of Elizabeth, but did not make much way till the middle of the 17th century. The chief seat of the industry has always been Redditch, in Worcestershire.

Negative. [PHOTOGRAPHY.]

Negritos (NEGRILLOS), Spanish diminutive of *Negro*, applied originally to the dwarfish Negro or Negroid aborigines of the Philippine Islands (Aetas or Itas), then by extension to the other populations of similar type in Malaysia, such as the Sakais of the Malay peninsula, the Karons of New Guinea, and the extinct Kalangs of Java; lastly to all dwarfish Negroid peoples, and more especially to those of Africa, Bushmen in the extreme south, Obongos in the extreme west, Batwa and many others scattered over the forest zone of the Congo basin. A Negrito element appears to have formed the substratum of the population in India, and this element has been traced by De Quatrefages and other ethnologists up the southern slopes of the Himalayas and as far west as the Sistan district on the Perso-Afghan frontier. Everywhere they are regarded as the true aborigines, probably sprung from a single stock which, in the early quaternary period, spread over the African, Oceanic, and South Asiatic regions at a time when a great part of the Indian Ocean was still dry land (the Lemurian continent), so that migrations could easily take place across the southern hemisphere from the Atlantic to the Pacific Ocean. Later these regions were invaded by higher or more powerful races, Negroes and Hamites in Africa, Papuans, Malays, and Polynesians in Oceania, Kolarians in India, by whom the Negritos were everywhere exterminated, dispersed, and broken into isolated groups and scattered fragments, as is now their normal condition in Malaysia and Central and South Africa, where alone they survive as distinct racial communities. These communities have been separated for so many ages that they no longer possess any kind of linguistic unity, if it ever existed, and many, as in the Philippines, the Malay peninsula and the Welle basin (North-east Congo Land) speak the languages of the more civilised intruders in their domain, either exclusively or jointly with their mother tongue. The physical type also differs considerably, though nearly all have in common a yellowish-brown complexion, never dark enough to be called black, a very pronounced prognathism, quite ape-like amongst the Simangs of the Malay Peninsula, the Javanese Kalangs, and the Akkas of South Mangbattuland (Welle basin), short, black woolly hair, usually spread in separate tufts over the scalp; disproportionately large head and small extremities; lastly, low stature, falling considerably

below that of all other races, and ranging generally from about $3\frac{1}{2}$ to $4\frac{1}{2}$ feet, but always under 5 and above 3 feet. Socially they stand also at the lowest stage of culture, with no arts, no religion, no agriculture, or stock-breeding, scarcely any fixed abodes, and these mostly frail huts or windward screens of branches and foliage; no food except the produce of the chase, vermin, roots and berries. On the other hand, many of the African groups display extraordinary skill, courage, and activity in attacking large game, such as the elephant and buffalo, with their bows and poisoned arrows, almost the only weapon of all Negrito tribes. They also show much natural intelligence, but are extremely difficult to domesticate, and scarcely any have ever been induced to adopt settled lives or conform to a rudimentary standard of culture.

Negro (Span. *Black*), a term popularly synonymous with "African," but in ethnology restricted to that section of mankind that is specially distinguished by its dark complexion, which, however, is rarely a true black. There are two main divisions, the Eastern or Oceanic, for which see PAPUANS, and the Western or Continental, *i.e.* the Negroes proper of the African continent. Here also there are two main divisions, the Southern, for which see BANTU, and the Central of Sudan, *i.e.* Bilad-es-Sudan, "Land of the Blacks," Negritia, Negroland, to which the typical African Negro is mainly confined. Even in this region, which ethnologically includes Upper Guinea, the White Nile, Welle, and Shari basins, the black aborigines have been largely encroached upon, mainly by the Berber and Galla Hamites, and the Arab Semites, with whom extensive interminglings have taken place. Hence many of the Sudanese populations who pass for Negroes are really Negroid, showing all the shades of transition between the true Negro and the Caucasian Hamites and Semites. Such especially are the Fulahs of west Sudan, not originally Negroes at all [FULAHS], the Hausas and Kanuri of central Sudan, the Mabas of Waday, the Furs of Dar-Fur, the Nubians of the Nile Valley, and many branches of the historical Sonrhay and Mandingan peoples. In general, wherever Mohammedan culture has been of long standing, miscegenation may always be suspected, and may be said to coincide with the prevalence of costume properly so-called, and of stone structures, for the true Negro never goes clothed, as do the Moslem Mandingans and Kanuri, and never raises stone buildings, such as those of Timbuktu, Kano, Katsena, and other Sonrhay and Hausa cities. With these reservations the Negro race proper will be found mainly confined to the western seaboard from the Senegal to the Niger delta, to a large part of the region enclosed by the great northern bend of the Niger; to the Upper Nile basin between the Sobat confluence and Lake Albert Nyanza; to nearly the whole of the Welle-Ubanghi basin, to the regions about the Congo, Chad, and Nile-Congo water-partings, and generally throughout South Sudan from the Niger delta eastwards to Dar-Fertit, Senaar, and South Kordofan.

In all these lands the Negro type proper is found

either exclusively or amongst the immense majority of the natives. Its chief characteristics are: dolichocephalic, *i.e.* long narrow head, with some important exceptions in the Nile and Welle basins where the Bongos, Zandebs [NIAM-NIAM], and others have round heads; black, woolly hair, mostly rather long, flat in transverse section, and distributed evenly over the scalp; scant or no beard; smooth, silky, and very dark brown skin, black or almost black amongst the Wolofs of Senegambia, the Nubas of Kordofan, the Nilotic Shilluks, and a few other groups; broad, flat nose; prominent cheekbones; thick, everted lips showing the red inner skin in marked contrast to the white teeth; large, black, round and prominent eye, with yellowish cornea, co-ordinate with a distinct yellowish tinge on the palms and soles; "larkspur" heels; large, massive, and even herculean frames, with thick skulls, but weak legs and long arms. But perhaps the most important physiological trait is the early closing of the cranial sutures, apparently arresting mental development, so that while Negro children are intellectually little inferior to others, the Negro adult remains throughout life little more than a child. He is cheerful and boisterous in his mirth, but thoughtless, improvident, and fitful, passing suddenly from comedy to tragedy, being at once affectionate and cruel, and also sensuous, the animal side being developed at the expense of the intellectual. For the same reason he is essentially unprogressive, making no spontaneous advance beyond the simple arts of coarse weaving and dyeing, iron- and copper-smelting, metal-working, wood-carving and agriculture. Some, such as the Yorubas and Mangbattus, build spacious and elegant houses and assembly halls, but always of wood and earth, so that architecture, such as it is, remains stationary, as does all Negro culture left to itself. Science, the fine arts, and letters are absolutely non-existent, and no Negro people have ever developed any kind of literature, or even reduced their language to written form. All Negro writings, without exception (the "Alphabet" attributed to a member of the Vei tribe, Senegambia, is spurious), are the work of other peoples, chiefly Christian and Mohammedan missionaries, and when these retire the community invariably lapses to the normal low level of Negro culture. Nearly all traces of the foreign cults rapidly disappear, and the non-theistic nature or demon-worship resumes its sway, with its attendant fetishism, and all the horrors associated with the universal belief in witchcraft.

Negroland presents in the immense diversity of its native idioms the sharpest contrast to Bantuland, where all known tongues are little more than dialects of two primitive stock languages, Bantu and Hottentot. In Sudan, on the contrary, the stock languages are reckoned by the score, and many, no doubt, still remain to be discovered in the almost unknown regions about the Congo-Chad water-parting and in Adamawa. In their structure they also differ from the southern group, the relational elements being mainly postfixes, whereas in the Bantu system they are mostly prefixes. As far as they are known, the chief Sudanese linguistic

families (stock languages) appear to be: *Mandingan*, with innumerable dialects widespread throughout west Sudan; *Fulah*, west and central Sudan; *Wolof* and *Serer*, between the Lower Senegal river and Cape Verd; *Bagnum*, *Felup*, *Nalu*, *Sumba*, between Cape Verde and Sierra Leone; *Timni*, *Bullom*, *Mendi*, *Gallina*, in Sierra Leone; *Pessi*, *Gola*, *Kru*, *Avikom*, *Agni*, Liberia and Ivory Coast; *Tshi*, *Ga*, *Ewe*, and *Yoruba*, Gold and Slave Coasts; *Igarra*, *Ibo*, *Okrika*, *Efik*, *Nupé*, Lower Niger, Niger delta, and Oil rivers; *Kissi*, *Sonrhay*, Upper Niger; *Mosso*, *Gurma*, *Gurunga*, *Borgu*, within the Niger bend; *Hausa*, *Kanuri*, central Sudan; *Baghirimi*, *Sara*, *Mosgu*, *Yedina*, *Kuri*, Lake Chad and Shari river; *Maba*, *Massalit*, *Kondonga*, *Fur*, *Nuba*, *Tegele*, east Sudan and Nubia; *Shuli*, *Bari*, *Dinka*, *Shilluk Bongo*, *Fajelu*, *Janghey*, *Fallanj*, *Luri*, *Madi*, Upper Nile and Sobat basins; *Mangbattu* (*Mombuttu*), *A-Zandeh*, (*Niam-Niam*), *A-Madi*, *Momfu*, *A-Barmbo*, *A-Babua*, *Nsakkara*, Welle basin. [Details under several entries.]

Nehemiah, the Jewish cup-bearer of Artaxerxes Longimanus, King of Babylon, heard at Susa in 445 B.C. of the sad state of Jerusalem, and the next year obtained leave to go there as governor. He built up the walls, brought in the population, especially the Levites, and instituted the Feast of Dedication. He paid a second visit twelve years later, and instituted many reforms, chiefly in the direction of keeping the race distinct and the observation of the Sabbath. These reforms probably caused the secession of the Samaritans. The book of Nehemiah forms a series with Ezra and Chronicles, but it is difficult to arrange the events narrated in their due order.

Neilgherry Hills (Sansk. "Blue Mountains"), near the Malabar Coast of South India, rise abruptly from the plains in an isolated mass, which is united with the Western Ghats by a granite ridge. The average height is 6,000 feet, and the greatest 8,760. The lower slopes are thickly wooded, and among the grassy uplands are many forest trees. There are five tribes, of which the Todas, few in number, are the most interesting. They are tall and powerful, speak a Dravidian dialect, practise polyandry, and are occupied chiefly in tending cattle. The climate is cool, and the hills form a health-resort for Utakamand.

Nelson, HORATIO, VISCOUNT, was born at Burnham Thorpe in 1758, and was educated at the high school of Norwich and at a school at North Walsham. In 1770 he left North Walsham to join the navy. In 1773 he volunteered to accompany an Arctic expedition which was undertaken at the request of the Royal Society. On his return in October he, during a cruise to the East Indies, was rated a midshipman. His subsequent career may be thus summarised: 1777 promoted to be lieutenant; 1778 promoted to be commander; 1779 posted; 1780 naval commander of the expedition which reduced Fort Juan, Nicaragua; 1793 appointed captain of the *Agamemnon*, serving at the sieges of Bastia and Calvi, where he lost his right eye; 1796 commodore; 1797 present at the battle of St. Vincent, promoted to be rear-admiral; attacked Teneriffe, where he lost his

right arm by a cannon shot; 1798 won the battle of the Nile, taking or destroying eleven ships and two frigates; made a vice-admiral 1801; in command of a detached squadron, won the battle of Copenhagen, taking or destroying fifteen Danish ships of war; 1801 left in supreme command in the Baltic, but was obliged to return to England on account of ill-health; 1803 was appointed to the chief command in the Mediterranean; 1805 assumed the command off Cadiz, where the allied French and Spaniards lay; October 21, 1805, perished gloriously in the moment of victory at the battle of Trafalgar. His body was brought to England in the *Victory*, and on January 9, 1806, buried in St. Paul's Cathedral crypt.

Nelson, ROBERT (1656-1714), was the son of a Turkey merchant in London, and was educated at St. Paul's. He went to Dryfield, in Gloucestershire, and was educated by Dr. George Bull. In 1680 he became a member of the Royal Society, and made a long tour in France and Italy with Halley. In 1683 he married, and the state of his wife's health caused him to be absent in Italy when the Revolution took place. In 1691 he became a Non-juror, but joined the Established Church in 1710. He worked on behalf of the Society for Promoting Christian Knowledge and the Society for the Propagation of the Gospel, and among his devotional writings the *Fasts and Festivals* is well known.

Nemesis (from Greek *nemo*, "distribute"), the Greek goddess who distributed good and ill fortune, worshipped at Rhamnus, in Attica, and elsewhere. The Greek notion of proportion led them to believe that a constant balance is maintained in human affairs, and that, however diverse the lives of nations and individuals may appear, the amount of good and bad fortune in each is always equalised in the long run. Thus an unwonted access of prosperity is sure to be followed by a corresponding period of depression and ill luck. This notion became blended with the conception of Zeus as a jealous deity ever ready to punish the arrogance which springs from excessive good fortune. Hence Nemesis was regarded as the impersonation of stern retributive justice.

Nematoda. [NEMATOIDEA.]

Nematoidea, a class of Vermes (q.v.), generally parasitic, with a mouth and alimentary canal. The sexes are separate; it includes the threadworms, round-worms, trichinidæ, etc.

Nemophila, a genus of annual plants belonging to the small gamopetalous order Hydrophyllaceæ, with pinnately lobed leaves and conspicuous flowers which are polysymmetric and have their parts in fives, except the carpels, which are two in number. Several species are grown in our gardens, the best known being *N. insignis*, a native of California, with a clear blue flower with a white centre.

Nennius, the name adopted by the author of *Historia Britonum*, a work which gives a mythical account of the Britons, the coming of the Romans, Vortigern and the Saxons, and the 12 victories of King Arthur. The work is not of great value except for fragments of earlier authors embodied in it, and

the authorship is sometimes attributed to Gildas or some person unknown. The original was probably in ancient Welsh.

Neocomian, from *Neocomum*, the Roman name of Neuchâtel, in Switzerland, is the name applied to the lower division of the Cretaceous system (q.v.), it being well developed in that district. It is there represented by several hundred feet of marls and massive limestones, the latter including the *Caprotinenkalk*, containing *Caprotina* and other Hippuritidæ (q.v.), the *Bryozoenkalk*, containing polyzoa, and the *Orbitolitenkalk*, containing foraminifera. These are all marine; but in England the series is represented by two distinct types of strata, one marine, and the other partly estuarine. The former is represented by the upper part of the Speeton Clay on the Yorkshire coast, and by the variable Tealby series in Lincolnshire. Besides ammonites (q.v.) characteristic of zones throughout the marine beds, the Middle Neocomian, including the Tealby beds, are characterised by the large scallop *Pecten cinctus*; and the Upper by the large oyster *Exogyra sinuata* and by *Perna Mulletii*. In the southern counties the fresh-water Hastings Sands (q.v.) correspond apparently to the Lower, and the Weald Clay (q.v.) to the Middle Neocomian, whilst conformably above this, and corresponding to the Upper Neocomian, come the marine beds of the Lower Greensand. [GREENSAND.] Neocomian rocks generally graduate conformably downwards into the Jurassic (q.v.); but are, sometimes at least, separated from the Upper Cretaceous by an unconformity.

Neolithic, the later stone age, the ill-defined division of the prehistoric part of the Human period, when man was no longer associated with many extinct mammals; when he used polished, and not merely chipped, stone implements; when he began to domesticate certain animals, to cultivate certain plants, to spin, to weave, and to make pottery. The history of this period is gathered from low-level gravels, cave deposits, peat-mosses, kitchen-middens, and especially from the Swiss lake-dwellings, and their evidence suggests the migration of a small, long-headed and probably Mongoloid race from Asia, bringing with them the dog, sheep, goat, and short-horn, and perhaps the domestic pig. They may also have brought jade (q.v.) from Asia, and seem to have practised a sort of inter-tribal barter. The mammoth and woolly rhinoceros were perhaps already extinct in Europe; but Neolithic man probably exterminated the great Irish deer (*Cervus Megaceros*), and was associated in Europe with the reindeer, the urus, and the grizzly bear, as well as the still existing beaver, brown bear, and wolf. The great shell-mounds (kitchen-middens) of Denmark, 3 to 10 feet high and sometimes 1,000 feet long, belong mostly to this period, as do also the lower peat-mosses of that country, in which the Scots fir (*Pinus sylvestris*) is the prevalent wood. [FLINT IMPLEMENTS.]

Neo-Platonism was the final outcome of Greek philosophy and religion, with an admixture of Oriental features. Greek philosophy, after reaching its full development in the systems of Plato and

Aristotle, gradually declined, amidst the decay of ancient civilisation, which forced the individual back upon himself, the satisfaction of man's spiritual needs became the object of the schools rather than the explanation of the physical or intelligible world, and intellectual vigour gave place to religious sentiment. Neo-Platonism represents the last stage in this process, and it was also the latest attempt to reconcile the rites and doctrines of different religious and philosophical systems. The founder of Neo-Platonism proper is said to have been Ammonius Saccas, who lived at Alexandria in the first half of the 3rd century A.D. The first and most eminent writer of the school was Plotinus. Under his successors Porphyry (233-303) and Iamblichus (d. 330) the tendency to polytheism and superstition became more marked; and, in spite of the efforts of the Emperor Julian, who strove to make Neo-Platonism a world-religion which should be a rallying-point for the expiring energies of Paganism, it was unable to cope with the growing power of Christianity. The return to a higher and purer form of Neo-Platonism at Alexandria in the early part of the 5th century was brought to a close by the tumult which led to the murder of Hypatia. At Athens the school lingered on, even displaying fresh energy under Proclus, who reduced the teaching of all his predecessors to a complete system; but 44 years after his death the Athenian school was closed by Justinian (529). Through the works of Dionysius (q.v.) the Areopagite Neo-Platonic doctrines were handed on to the Middle Ages, and became the source of Christian Mysticism.

Neoscorpia, a sub-order of Scorpions (q.v.), including those in which the median eye-tubercles are some distance from the anterior margin and behind the lateral eyes.

Nepal, a kingdom lying between British India and Thibet, occupies the southern range of the Himalayas for about 500 miles and extends 20 miles into the plains. It has an area of 56,800 square miles, and is extremely mountainous, the general heights varying from 2,000 to 6,000 feet. Mount Everest is in this country. The lower hills are thickly wooded, and abound in animals, and the soil produces copper, iron, sulphur, marble, and crystal. The chief manufactures are cloth, iron, copper, and brass vessels, and bell-metal, and there is a brisk commerce with Thibet and British India, the exports to the latter amounting to the value of £1,500,000. Among the articles exported are rice, oil-seeds, opium, musk, falcons, furs, ginger, yaks' tails, etc. The people are of Mongolian type, the upper classes being Hindu in religion and the lower Buddhists. Nepal was invaded by Hindus in the 14th century, and by Goorkhas in 1767. A war with England in 1814 led to a treaty in 1816, and friendly relations have since been established and maintained. The capital is Khatmandu.

Nepenthes. [PITCHER-PLANTS.]

Nepheline, a mineral silicate of alumina, soda, and potash, crystallising in hexagonal prisms, generally clear, colourless, and glassy, but small. Its hardness is 5.5 to 6; its specific gravity 2.5 to 2.6.

It derives its name from the Greek *nephelē*, "a cloud," because it becomes cloudy on immersion in nitric acid before gelatinising. It is fusible. Nepheline is an essential constituent of phonolite (q.v.), and occurs also in other lavas.

Nephrite. [JADE.]

Nephritis. [BRIGHT'S DISEASE.]

Nepomuc, ST. JOHN, a Bohemian saint, so called from the name of his birthplace, is said to have lived in the 14th century. He made a great reputation for himself as a preacher, but in some way incurred the anger of the Emperor Wenceslaus, by whose orders in 1383 he was drowned in the Moldau. Nepomuk was canonised in 1721. The whole story is probably mythical.

Nepos, CORNELIUS, a Roman historian of the 1st century before Christ, was a native of Verona. He died some year between 30 and 20 B.C. Little is known of his life, but that he was a friend of Cicero and Catullus. The only extant work of Nepos is his *De Viris Illustribus*, and even of this the authorship is doubtful.

Neptune (NEPTUNUS), the Latin god of the sea, is identical with the Greek Poseidon (q.v.). The name is supposed to be a contraction of "Navitunus" connected with *naiein* or *natare*, "to swim." Neptune was the brother of Jupiter and Pluto, and was always offered a sacrifice (which was afterwards thrown into the sea) at the outset of any naval expedition. His temple was in the Campus Martius, and his festival was kept on July 23 (x. Kal. Sext.).

Neptune is that planet in the solar system which is farthest from the sun, the distance between the two bodies being about 2,750,000,000 miles. At this immense distance it will, according to Kepler's laws (q.v.) take a long time to travel once round its orbit, and this time has been found to be 165 of our years. Although it is 97 times as large as the earth, yet, on account of its enormous distance from us it can only just be seen, even with a tolerably powerful telescope. Until the middle of the present century Neptune was considered as a star, but in 1846 Adams and Leverrier considered that a variation in the motion of the planet Uranus must be due to an undiscovered planet. From the disturbance of Uranus they were able to calculate the size and position of this new planet, and from their data Galle was led to its actual discovery by the telescope. Lassell has found that Neptune possesses one satellite, which moves round the planet in rather less than six days and is 222,000 miles away from it. No appearances in Neptune have enabled astronomers to calculate its rotation about its own axis, but it is extremely probable that it does rotate and that this motion is in the same direction as its motion round the sun.

Nerbudda, a river of Hindustan, rises in the state of Rewa, and flows in a westerly direction, through the Central Provinces, emptying itself into the bay of Cambay near the town of Broach. It has a course of some 800 miles, but is of little use for navigation owing to the numerous rapids by which it is impeded. The Nerbudda is a sacred stream.

Nereid. [NYMPH.]

Neri, ST. FILIPPO DI (1515-95), founder of the Oratorians, was born of noble parents at Florence. Having studied at Rome, he was ordained to the priesthood in 1551, and soon became famous for his piety and his charitable deeds. He also took a leading part in the internal reformation which was begun in the Roman Church almost at the same time as the external movement. The congregation of the Oratory was founded by him in 1564, and approved by the Pope in 1577. Neri was canonised by Gregory XV. in 1622. [ORATORY.]

Nero, EMPEROR OF ROME, was the son of Cneius Domitius Ahenobarbus and Agrippina, daughter of Germanicus. He was born at Antium in the year 37, and adopted when he was thirteen by the Emperor Claudius, whose daughter Octavia became his wife soon after. In spite of the fact that Claudius had a son, Nero was proclaimed emperor on the death of the latter in 54. His reign, which lasted for thirteen years, was marked by the subjugation of Armenia, by revolts of the Jews, and by the rising of Buddug, or Boadicea, in Britain. Nero poisoned Britannicus, son of Claudius, had his mother Agrippina assassinated, and then banished and put to death his wife Octavia, whom he had divorced in order to marry his mistress Poppæa. The latter he killed, and then married the notorious Messalina, after Antonia, daughter of Claudius, had been put to death for rejecting his proposals. Seneca, Lucan, Corbulo, and Thrasca Pætus were also amongst his victims. Many Christians were also put to death on account of the fire at Rome in 64, the planning of which Suetonius and Dion attribute to Nero himself. In 68 risings took place in Spain and Gaul, and Nero, being deserted by the troops at Rome, put an end to his life.

Nerva, MARCUS COCCEIUS, EMPEROR OF ROME, was born in 32. On the assassination of Domitian in 96, he was declared emperor. In the course of his short reign of two years he put down the prevailing systems of perjured informations, reduced the public expenditure, and distributed land among the poorer citizens. Nerva died suddenly in 98, having adopted Trajan as his successor.

Nerval, GÉRARD DE (1808-55), *nom de plume* of GÉRARD LABRUNIE, who was born at Paris and educated at the Lycée Charlemagne. His first work was a translation of *Faust*. He afterwards travelled in Europe, Egypt, and western Asia, and lived a stormy and dissipated life, the end of which was probably suicide. To literature he contributed exquisite short stories, *Contes et Facéties, etc.*, *La Bohème Galante*, some poems, and *Aurélien, ou le Rêve et la Vie*. In 1852 he also published *Les Illuminés, ou les Précurseurs du Socialisme*.

Nerve. Nervous tissue is made up of nerve-fibres and nerve-cells. The latter are found in certain situations in the central nervous system, and are also met with in the ganglionic enlargements which occur in the course of some nerve trunks. The nerve-fibres are bound together in groups forming nerves, and these serve for the

transmission of nervous impulses and for intercommunication between peripheral nerve terminations and the nerve-centres in the brain and spinal cord. If a section is made of a nerve-trunk, the appearance presented is that depicted in the figure. A number of nerve-bundles are seen cut across, each containing a multitude of nerve-fibres held together by connective tissue. Each bundle is surrounded by a connective tissue sheath, and the several bundles are held together by a further interlacement of connective tissue fibres.

An individual nerve-fibre can be studied by isolating it from surrounding fibres, a procedure which can be effected by tearing a minute piece of nerve with needles so as to split it up and separate the individual fibres one from another. It will be found that nerve-fibres are of two kinds—*medullated* or white fibres, and *non-medullated* or grey fibres. Medullated fibres consist of three parts, an outer sheath (the *neurilemma*), enclosing the fibre and presenting here and there on its inner surface a nucleus, an internally situated axis cylinder, and an intermediate substance of a fatty nature, known as the white substance of Schwann, or medullary sheath. The axis cylinder is the portion of the nerve fibre which conducts nervous impulses, the other parts of the fibre serving merely for protection and insulation. The axis cylinder is made up of a number of minute fibrillæ, and at its terminations a nerve loses its medullary sheath and the cylinder becomes split up, the component fibrillæ ramifying and forming a network, whether it be at the peripheral termination of the nerve, or at the point where the nerve breaks up in the central nervous system.

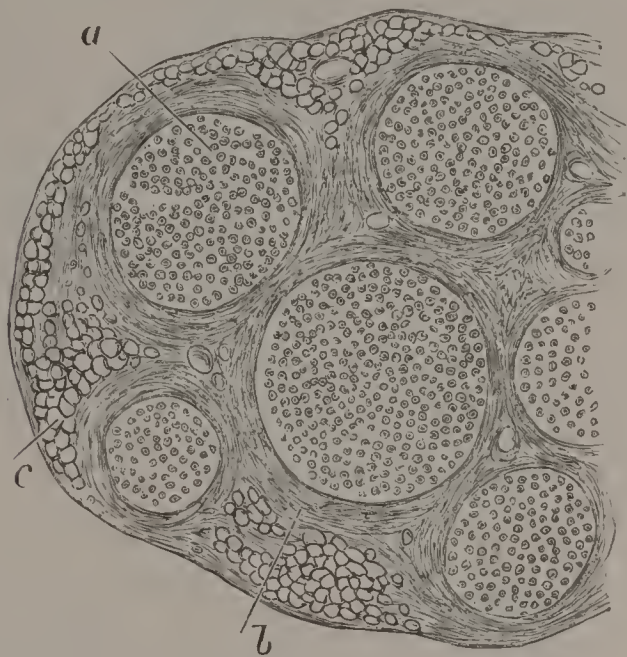
Non-medullated fibres are found in the trunks of cerebro-spinal nerves mingled with the medullated fibres, and they constitute the sole variety of fibre met with in the olfactory and auditory nerves and in the nerves of the sympathetic system. These non-medullated fibres possess no white substance of Schwann and thus resemble the terminal portion of the ordinary medullated nerve fibre. The medullary sheath is not continuous throughout the length of an ordinary nerve-fibre, but is interrupted from place to place, a constriction being present at such points of interruption, and these points are termed *nodes of Ranvier*. The other constituent of nervous tissue which has been alluded to, the ganglion cell, is a cell enveloped in a capsule, possessing a nucleus and one or more processes; the cell is said to be unipolar, bipolar, or multipolar, according to the number of processes which radiate from it. In certain situations—notably in the anterior horns of the grey matter of the spinal cord—a process of a ganglion cell has been traced and shown to be continued as the axis cylinder of a nerve-fibre. Thus in some instances axis cylinders originate directly



NERVE-FIBRES.
Showing the axis cylinders, nodes of Ranvier, and nuclei lying beneath the neurilemma.

from ganglion cells. In other cases an axis cylinder takes origin by the collection of fibrillæ from the network in the nerve-centre, such fibrillæ being grouped together and so forming the central core of the fibre.

The peripheral termination of a nerve may consist in a mere splitting-up of the axis cylinder into fibrillæ, this arrangement being well seen in the cornea; or a nerve termination of some complexity of structure may be met with. Examples of such peripheral nerve-endings are the Pacinian corpuscles, which occur in the palm of the hand and sole of the foot in man and in the mesentery of the cat, the nearly allied corpuscles of Herbst and of



TRANSVERSE SECTION OF A NERVE-TRUNK.

a, Nerve-bundle; b, connective tissue sheath of same; c, fat cells.

Meissner, etc., and the peculiar nerve end-plates which are met with at the ultimate termination of the axis cylinders of striped muscle,

The functions of nerves are various. Some conduct impulses from a nerve-centre to the periphery; these are called *efferent* nerves, *e.g.* the nerves supplying muscle, nerves which regulate the calibre of blood-vessels, nerves which influence secretions. Nerves which conduct impulses from the periphery towards the centre are called *afferent* nerves; such are the nerves of ordinary sensation, of special sense, and of what is known as muscular sense. The rate at which impulses are transmitted by nerves has been carefully investigated, and it has been shown to be rather more than 100 feet per second in the motor nerves of man. In the case of nerves originating from the spinal cord, it is found that each trunk is connected with the cord by two bundles—the anterior and posterior roots. Near the junction of these and situated on the posterior root, is a ganglionic enlargement. It has been demonstrated experimentally that the anterior root of a spinal nerve is concerned in transmitting impulses from the centre to the periphery (*efferent* impulses), while the posterior root transmits impulses in the reverse direction (*afferent* impulses).

The various nerve-trunks belong to one of two systems, the *cerebro-spinal* and *sympathetic* systems.

The cerebro-spinal nerves consist of the 12 pairs of cranial nerves taking origin from the base of the brain, and of the spinal nerves, 31 pairs in all, which originate from the spinal cord and which are termed according to the part of the cord from which they emanate, cervical (eight pairs), dorsal (twelve pairs), lumbar (five pairs), sacral (five pairs), coccygeal (one pair). The first pair of cranial nerves are the olfactory nerves, and the second the optic nerves. The third, fourth, and sixth pairs are concerned with the movements of the muscles of the eye. The fifth pair are mainly sensory and distributed to the face, but each gives off a branch which innervates the muscles of mastication. The seventh pair are concerned with the movements of the facial muscles. The eighth pair are the auditory nerves; the ninth pair, known as glosso-pharyngeal nerves, are the nerves of taste, the tenth pair, the pneumo-gastric or vagus nerves have a wide distribution, supplying the heart, lungs, and stomach; the eleventh pair are the spinal accessory nerves, and the twelfth, the hypoglossal nerves, supply the muscles of the tongue.

The spinal nerves, shortly after their taking origin from the cord, communicate with one another, forming what are known as plexuses. Such are the brachial plexus, formed by the lower cervical and first dorsal nerves, and the lumbar and sacral plexuses.

The sympathetic system of nerves take origin from two main chains, situated on either side of the spinal column. In connection with these chains are a number of ganglionic enlargements, the sympathetic ganglia. Three such ganglia occur in the neck, the superior, middle, and inferior cervical ganglia, and a number of other ganglia are met with in the thorax. From the thoracic portion of the sympathetic system arise the three splanchnic nerves, which pass downwards to innervate the abdominal viscera. In relation with the sympathetic system of nerves are found a number of plexuses, *e.g.* the cardiac plexuses, the great solar plexus, situated in the upper part of the abdomen, with which are connected a number of subsidiary plexuses, and finally the hypogastric and pelvic plexuses.

Ness, LOCH, the second in size of the Scottish lakes, is in Inverness-shire, a little to the south-west of Inverness. It is more than 20 miles long, and has a total area of 19 square miles. It is surrounded by high mountains, and is very deep.

Nesselrode, KARL ROBERT, COUNT (1780–1862), the Russian diplomatist, was born at Lisbon. He played an important part at the Congress of Vienna, and in the negotiation of the Holy Alliance, and under the Emperor Nicholas directed the foreign policy of Russia to a large extent. He, however, opposed the Crimean War, and on the accession of Alexander II. retired from public life, though nominally Chancellor for some years longer.

Nessler's Reagent is prepared by dissolving mercuric iodide in a solution of potassium iodide, with the addition of caustic potash. An almost

colourless liquid is so obtained which gives a yellow coloration, with faintest trace of ammonia or an ammoniacal compound. It is employed on this account for the estimation of ammonia in potable waters.

Nest, a place or structure where birds deposit their eggs and rear their young. Nests vary greatly in character, from the mere depression in the ground of gulls and sandpipers to the dome-shaped, felted structure of the bottle-tit. The term is also applied to the breeding-places of some reptiles and fishes [see cut under ACANTHOPTERYGIAN], and to the dwellings of ants, wasps, and wild bees. Less properly it is used for the dray of the squirrel and the shelter of the orang-utan.

Nestor, one of the Greek mythical heroes, was son of Neleus and Chloris, and husband of Eurydice. His youth was spent in warlike exploits, but in the Trojan expeditions he is the great counsellor of the Greeks. After the fall of Troy he returned to Pylos, in Messenia, where he ruled his people for many years.

Nestorians, Christian sectaries, long established in the Lake Urmia district, north-west Persia, the Kurdistan mountains, about the Perso-Turkish frontier, and in Mossul, Diarbekr, and other places in the Upper Tigris Valley within the Turkish frontier; total population, about 200,000, many of whom have in recent years accepted the teachings of English and American Protestant missionaries. The term *Nestûri* (Nestorian) is of doubtful origin, and is repudiated by these communities, who disown the heresiarch Nestorius. It is probably a corrupt form of *Nasserâni*, a common name in the East for Christians, from *Nazareth* of Galilee; but they call themselves *Kaldani*, i.e. Chaldæans, and appear to be a remnant of the old Semitic Christian people of Mesopotamia, who were of Chaldæan or Assyrian stock. They now mostly speak Arabic and Persian, but their liturgical language is a modernised form of Assyrian (Chaldæan), with numerous Syrian elements as well as Arabic and Persian words, and written in a peculiar character derived from the Estranghelo (Old Syriac). Some are still in the tribal state, such as the Kojamis about the head-waters of the Tigris (1,000 families), and the Tiaris, in the Sulamani district (10,000 families).

Nettle, the name applied primarily to the species of the genus *Urtica*, well-known for their stinging hairs. They are mostly erect, herbaceous plants, with opposite serrate leaves, greenish unisexual and apetalous flowers, and minute, dry, one-seeded fruits. The sting is an unicellular hair, filled with formic acid (q.v.), with a bulb-like base pressed by surrounding cells, and a sharp hooked point that readily catches in the skin and breaks off. There are two species of nettle, common as weeds in cultivated ground, which may perhaps be indigenous in England—*U. dioica*, the large, and *U. urens*, the small nettle. Some exotic species reach a large size, and their sting may even prove fatal. Both British and foreign species have long been used as a source of fibre. Though gritty

from the numerous crystals in their cells, young nettle-tops may be eaten like spinach or asparagus. The name has been extended to the *dead-nettles*, species of *Lamium*, merely on account of the resemblance of their hairy, but harmless, leaves to those of true nettles.

Nettle-Rash. [URTICARIA.]

Nettle-Tree (*Celtis australis*), a handsome tree, thirty to forty feet high, with smooth bark, brown on the trunk and grey on the branches, and deciduous leaves resembling those of the nettle, whence its name. It occurs chiefly in the Mediterranean region; but, though its wood is very hard, takes a high polish, and is ornamental, it is but little cultivated. It is one of some seventy species of the genus *Celtis*, a member of the elm family, distinguished chiefly by its small fleshy fruit or "drupe." This is eaten in Spain and Greece, and may perhaps be the lotus (q.v.) of the ancients. *C. occidentalis* and other American species are generally known as Hackberries.

Neuchâtel, a Swiss canton, having Vaud on the south, Solothurn and Basel on the north, and the French frontier on the west. On the east is the lake of Neuchâtel. In 1707 the principality of Neuchâtel belonged to the house of Brandenburg, having previously belonged to Burgundy, the Counts of Châlons, and the Longuevilles. Napoleon bestowed it in 1807 upon Berthier, but in 1814 it passed again to the king of Prussia. In 1848 a republic was set up, and Prussia abandoned her claims to the sovereignty. The people are chiefly French-speaking Protestants. The canton is traversed by the Jura range, and is watered by affluents of the Rhone. The lake itself is nearly 1,500 feet above sea-level. It is 25 miles long, and six broad in the widest part, and is very deep. The chief industries of Neuchâtel are watch-making, lace-making, and the brewing of wine. Asphalt and absinthe are exported. The capital of Neuchâtel has the same name, and stands on the lake. Neuchâtel cheeses are made not here, but at a small town in Normandy.

Neuilly, a suburb of Paris, is about half a mile north of the Bois de Boulogne, and the same distance east of the Seine. The Château de Neuilly built by Louis XV. was the favourite palace of Louis Philippe. It was burnt by the revolutionists in 1848.

Neuralgia, pain occurring in the course of a nerve (the term is derived from two Greek words signifying "nerve-pain"). Neuralgia may be due to injury of a nerve, or to its involvement by disease affecting parts adjacent to it, as in caries of the spine, hip-joint disease, etc. The common forms of neuralgia are those which occur in association with anæmia and hysteria. The subjects of malarial disease occasionally suffer from severe neuralgia. The symptoms are pains of a paroxysmal character occurring in the course of distribution of a nerve. There is sometimes some loss of sensation (anæsthesia), and usually tenderness on pressure (hyperæsthesia). There are often, moreover, certain

definite painful spots, the situation of these being dependent upon the particular nerve involved. In facial neuralgia, for example, the points of emergence of the three branches of the fifth cranial nerve from the bony skull are particularly noteworthy as being such painful spots. Again, in intercostal neuralgia and in sciatica there are definite spots which are painful on pressure. A variety of neuralgia usually affecting the fifth nerve is known as *tie douloureux*. This disease is happily very rare; the pain is intense, and is accompanied by spasmodic contraction of muscles, whence the term *epileptiform* neuralgia, which is sometimes applied to it. The treatment of neuralgia consists, for the most part, in the treatment of the condition with which the neuralgic pain is associated. In anæmia, for example, the use of iron is attended with much benefit. In malaria, quinine is invaluable. Locally counter-irritation is often employed, and electricity has been found useful in some instances. The employment of morphia should not be lightly undertaken. In the severest forms of neuralgia its use may be necessary.

Neuritis, inflammation of the trunk of a nerve. Multiple neuritis is a disease in which many nerves throughout the body become affected by inflammation. This occurs, for example, after certain cases of diphtheria, in locomotor ataxia, in beri-beri (a malady met with in Japan and other Eastern countries), in leprosy, and in what is known as alcoholic neuritis. The chief symptoms in this last-named disease are paralysis of muscles and sensory irritation, there being usually intense cutaneous hyperæsthesia. Alcoholic neuritis is a rare form of malady; it usually occurs in women, and runs, as a rule, a protracted course.

Neuroptera, an order of insects also known as the Odonata. They have a masticatory mouth, four membranous wings which are approximately equal in size, and are strengthened by a lattice-like series of nerves. They have an incomplete metamorphosis. [INSECTS.] The order is estimated to include about 5,080 species. The best known members of the group are the Dragon-flies, May-flies, White Ants, and Caddis flies; it also includes the Ant lions, Scorpion flies, and Aphid lions.

Neustadt, an Austrian town some 30 miles south of Vienna, was founded in 1192. Less than three centuries later was built a large castle (now used as a military school), in the chapel of which Maximilian I. was buried. There is also a 13th-century church and a Cistercian abbey founded in 1444. There was a great fire in 1834, after which the town was rebuilt. The Austrian town is known as Wiener-Neustadt to distinguish it from Neustadt in Silesia and Neustadt-an-der-Hardt in Bavaria.

Neustria, the name of the western part of the Frankish empire after its division, extended originally from the Scheldt to the Loire, and had Burgundy as its eastern boundary. Paris was its chief town.

Neutral Substances are substances which do not exhibit either an acid or an alkaline reaction. Thus acids change the colour of litmus from blue to red, while alkalis have a reverse action, and a neutral substance has no action upon either red or blue litmus. If an alkali be added to an acid, the properties of the acid are neutralised, and eventually the solution becomes neutral and contains a neutral salt. The quantities of acid and alkali then used are said to be *equivalent* to one another.

Neuville, ALPHONSE MARIE DE (1836–85), French painter, was born at St. Omer. His pictures are chiefly battle-scenes, including those of *Tel-el-Kebir*, *Rorke's Drift*, and many actions in the Franco-German War, in which he served as a soldier. He also designed illustrations for Guizot's *History of France* and other works.

Neva, the river of St. Petersburg, flows from Lake Ladoga into the Gulf of Finland, its whole course being only about 40 miles. It is about two-thirds of a mile wide in the broadest part, and carries an immense volume of water. It is frozen over throughout the winter. The Ladoga Canal connects it with the Volga.

Nevada, one of the largest, but the least populous, of the United States of America, lies between California and Utah, having Oregon on the north-west and Arizona on the south-east. Its lakes and "playas" are the remains of what was once a great inland sea. Numerous ranges of mountains traverse the country, the remainder of which is a plateau about 4,000 feet above the sea-level. The only river of importance is the Humboldt, which runs across the north of Nevada, from east to west. The climate is very dry, and in some districts it is said that no rain falls for two or three succeeding years. Hot springs are a feature of the country, which is of great interest to the geologist. In 1859 the discovery of silver began to attract settlers. The output of this metal has since been very large. Nevada became a state of the Union in 1864. It is divided into thirteen counties. The capital is Carson, the only other towns of importance being Virginia City, and Gold Hill. The state university is at Reno.

Nevers, the chief town of the department of the Nièvre, France, and formerly of the province of Nivernais, stands on a high hill at the foot of which flows the Loire. Its history dates back to the time of Cæsar's Gallic wars, when it was called Noviodunum. Nevers has a fine cathedral, the west part belonging to the 13th century; a palais de justice, formerly the residence of the Dukes of Nevers; and a triumphal arch, commemorative of Fontenoy. Cannon-founding and the manufacture of *faïence* are the chief industries.

Nevis, one of the Leeward Islands, was discovered by Columbus in 1493, and colonised by the British early in the 17th century. It has an area of 50 square miles. The land slopes down from a cone in the centre which is 3,200 feet high. Hurricanes and earthquakes have been frequent, but the sugar-cane has been successfully cultivated.

Nevis was formerly a great slave mart. Charles-town is the capital. The island sends three representatives to the Legislative Council, which it shares with St. Christopher.

Newark, a town of New Jersey, U.S.A., on the Passaic river, was settled from Connecticut in 1666. It is a fine place, with many handsome buildings, and is important commercially, being connected with New York both by railway and river steamers. Besides its docks, Newark has brass- and iron-works, boot- and shoe-manufactories, as well as establishments for the production of clothing of all sorts, carriages, trunks, and various kinds of machinery.

Newark-on-Trent, a town in Nottinghamshire, midway between Nottingham and Lincoln, stands not actually on the Trent, but upon a small tributary of it, the Devon. It takes its name from its castle, the "New Work," which was built in 1125 by the then Bishop of Lincoln on the ruins of a Saxon building. The grammar school dates from 1529, and the beautiful parish church from the two preceding centuries. Newark is an important centre of the corn trade and malting industry. It was incorporated by Edward VI., and returned two members to Parliament till the 3rd Reform Bill, when it was disfranchised.

New Bedford, a fine town in Massachusetts, U.S.A., stands on the Acusket estuary, about 50 miles south of Boston. It was, till the middle of the 19th century, the centre of the American whale fisheries, but has since then been chiefly occupied in the manufacture of cotton. It has a public library and high school, and Clarke's Point is defended by a granite fort.

Newbery, JOHN (1713-67), a London bookseller, was the son of a Berkshire farmer. About 1744 he set up in London as a seller of books and medicines. He was the first to publish children's books, some of which he helped to write. In Newbery's *Universal Chronicle* Dr. Johnson's *Idler* first appeared, and in his *Public Ledger* Goldsmith's *Citizen of the World*, at first called *Chinese Letters*.

New Brunswick, that part of the Dominion of Canada which lies between the province of Quebec and Nova Scotia, originally formed part of the latter. It was partially colonised by the French in the 17th century, but was taken possession of by the British in 1760, and ceded to them by the treaty three years later. Scotch settlers arrived in 1764, and after the American War, loyalist emigrants also came to New Brunswick, which was first separated from Nova Scotia in 1784. The climate is subject to great extremes of heat and cold. The country is hilly in the south, elsewhere gently undulating. The principal rivers, in which there is good salmon- and trout-fishing, are the St. John, the Miramichi, and the Restigouche. There are many small lakes, Grand Lake, the largest, being 30 miles long and 7 miles wide at the broadest. The wide extent of coast-line

contains many excellent harbours. Northumberland Strait divides the province from Prince Edward Island; and Chaleur Bay lies between New Brunswick and Quebec. The chief article of export is timber; but crops of all kinds are grown from the fertile soil. As in other colonies, grants of land may be obtained by settlers on very easy terms. The fisheries are prolific, and coal, silver, lead, copper and other minerals are found. The area of the province is 28,200 square miles. The largest town is St. Johns, but the capital is Fredericton. New Brunswick is governed by a Lieutenant-Governor and Executive Council, assisted by a Legislative Council of 17 and an elected Assembly of 41 members.

New Brunswick, a town of New Jersey, U.S.A., stands on the Raritan river, some 30 miles south-west of New York. It has large indiarubber factories. In it are Rutgers College, founded in 1771, connected with the Dutch Reformed Church, a state agricultural college, and a Roman Catholic cathedral.

Newbury, a market-town of Berkshire, England, stands on the Kennet 17 miles south-west of Reading. The town was founded on the site of an old Roman station (hence the name), and was incorporated in 1596. The fine Perpendicular church was restored in 1867. There are several good modern buildings. Two battles were fought in the neighbourhood during the Great Rebellion. In the first, which took place on a hill to the south of the town, Essex defeated the Royalists (September 30, 1643), Falkland falling in the battle; the second (Oct. 27, 1644), the scene of which was the country to the north, was indecisive in character.

New Caledonia, an island in the South Pacific, lies between lat. 20° 10' and 22° 25' S. and long. 164° and 167° E. It is about 240 miles long and from 20 to 25 broad. It is surrounded by coral reefs; but there are some good harbours, notably that of Noumea on the south-east. The island was discovered by Captain Cook in 1774, and occupied by France as a convict settlement in 1854. Politically it forms one with the Loyalty and other surrounding islands. New Caledonia is mountainous in the interior, but has fertile valleys, in which several fruits, tobacco, and coffee are grown. The nickel-mines are valuable, and there is other mineral wealth. Turtle and fish abound, and so also do the destructive locusts. Leprosy is common amongst the aboriginal inhabitants, who were until comparatively recent times cannibals.

New Caledonians, the aborigines of the French colony of New Caledonia, South Pacific Ocean, of Melanesian stock [MELANESIANS]; still mostly in the wild state, and rapidly diminishing in numbers through contact with European vice, drink, and epidemics (fell from 70,000 in 1845 to 23,000 in 1890); and, as they refuse to work on the plantations, they are being steadily supplanted by coolies imported from the Loyalty and New Hebrides archipelagoes.

Newcastle, in New South Wales, at the mouth of the Hunter river, has a fortified harbour and is the chief port of the north coast. Its shipping trade is little less important than that of Sydney.

Newcastle-on-Tyne stands on the north bank of the Tyne, 8 miles from its mouth. The "new

bridge. Newcastle sends two members to Parliament.

Newcastle-under-Lyme, a town of Staffordshire, England, is 35 miles south of Manchester. It derived its name from the rebuilding of its castle by Henry I.; the forest of Lyme lay to the north.

The town was incorporated by Henry II. It has a well-endowed high school; the old parish church was rebuilt in 1876 under the supervision of Sir Gilbert Scott. Paper-making and brewing are now the chief industries, the hat manufacture having decayed. Newcastle-under-Lyme has been a parliamentary borough for more than five centuries, but the representation was reduced in 1885 from two members to one.

New-Chwang, a Chinese city, stands on the river Liao, in Manchuria, 120 miles east of Mukden. Ying-tzu, lower down the Liao, is really the treaty-port, as vessels are not able to get up so high as New-chwang. This port, which is closed by ice during the winter, formerly imported large quantities of opium; it now chiefly takes in manufactured goods, beans and silk being

the chief exports. A large salt industry is carried on in the neighbourhood.

Newdigate, SIR ROGER (1719-1806), founder of the prize for English verse given annually at Oxford, was a native of Arbury, Warwickshire, and for many years member of Parliament for the University. Among the winners of the Newdigate have been Heber, Milman, Lord Selborne, A. P. Stanley, Mr. Ruskin, and Matthew Arnold.

New England, a name given by Captain John Smith, author of *The Description of New England* (1616), to the north-eastern part of the United States territory. The term includes Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island.

New Forest, THE, a part of south-western Hampshire, covering upwards of 92,000 acres, has been so-called since the year 1079, when William I. created it for hunting purposes. Two of his sons met their deaths in it. Severe forest laws were enacted and enforced. In 1851 the deer were taken away, and since 1877 the forest has been managed by a Court of Verderers in the interests of the public. There are fine oaks and beeches, and rare butterflies and insects are to be found.

Newfoundland, an island at the mouth of the St. Lawrence, belonging to Great Britain, is 370 miles long and 290 broad, having a total area of 40,200 square miles. Originally discovered by the Norwegians, it was again sighted by Cabot in 1497. After Sir Humphrey Gilbert's expedition had been



GRANGE STREET, NEWCASTLE.

Poulton & Son, Lee, phot.

castle" from which it takes its name was built between 1172 and 1177 on the site of the older one erected by Robert, son of William I. The Blackgate still remains, and the Keep is perhaps the finest specimen of secular Norman in England. The germ of Newcastle was the Roman Pons Aelii. During Saxon and early Norman times the town was ecclesiastical, and was known as Monkchester. It was incorporated by Henry II., and in 1400 was given the privileges of a county. The corporation was remodelled in 1835, and the government is now in the hands of a mayor, 16 aldermen, and 48 town-councillors. The chief buildings of interest, besides the castle, are the cathedral of St Nicholas (chiefly Decorated), with a Perpendicular lantern tower; St. Andrew's church (11th century); St. John's church (14th century), with an ancient font; and, among more modern structures, the Corporation buildings, the Moot Hall, and Allen's endowed schools. Newcastle was largely rebuilt by Richard Grainger, one of the citizens, who died in 1861. Among educational and benevolent institutions are the Colleges of Medicine and Science, the Free Grammar School, the Royal Infirmary, the Northern Counties Orphan Institution, etc. The chief industries of the place are the coal trade, ship-building, and the making of engines of all kinds, cannon, carriages, glass, bricks, and tiles. At Lord Armstrong's works at Elswick ironclads are also constructed. Newcastle is connected with Gateshead, on the south bank of the river, by the High Level bridge, designed chiefly by Robert Stephenson, the swing bridge, and the Redheugh suspension

quickly followed by his death, it was claimed for Queen Elizabeth by Drake in 1585. In the following century British colonies were founded on the island, but it was not till the Treaty of Utrecht (1713) that it actually became a British possession. Soon after this, fishery disputes commenced between English and French, and have never really ceased. In 1762 France actually held for some months some places in the island. The chief characteristic of the physical geography of Newfoundland is the abundance of fresh-water in the shape of lakes and ponds. The coast-line is much broken, and has several excellent harbours. Excellent timber is obtained, and the island is rich in copper, lead, gypsum, and slate. The fisheries, however, employ the greater part of the population; of these, the cod-fishery is the most important. It is carried on along the shore of Newfoundland, on the "Grand Bank," and off the coast of Labrador, in or about whose harbours the fishermen live during the season. Large numbers of seals are also annually killed and exported to England, and lobster-canning is also an important trade. In 1832 Newfoundland received a constitution, and in 1855 responsible government was established in the colony. The Administration consists of a Governor appointed by the Crown, an executive Council of seven, a legislative Council of fifteen, and a representative Assembly of thirty members. Newfoundland is the only part of British North America which does not form part of the Dominion of Canada. In 1839 it became an episcopal see. St John's is the chief town and seat of government. It is to be noted that the small islands of St. Pierre and Miquelon, lying to the south of the colony, are still French possessions and are the centre of a rival fishery trade.

Newfoundland Dog, a breed of large water-dogs, introduced into England from Newfoundland, where they are used to draw sledges and small carts. The coat is long and curly, but not so close as that of the Spaniel or the Retriever. Black is the colour of pure Newfoundlands, black and white dogs being known as "Landseer" Newfoundlands, from the dog in Sir E. Landseer's picture *A Distinguished Member of the Humane Society*. Newfoundlands are good-tempered, though somewhat uncertain, of great intelligence, admirable waterdogs; as watch-dogs they almost rival the mastiff, and from them the Retriever is derived by crossing.

Newgate. The old London prison was so called from its having been originally situated in the portal of the New Gate of the city. The old building, built from the fruits of a legacy of Sir Richard Whittington, was destroyed in the fire of London. In 1780 the present buildings were erected, but were damaged by fire during the Gordon riots, when most of the prisoners were set free. Since the passing of the Prisons Bill (1877) Newgate has been little used.

New Guinea, a large island in the South Pacific, having an area of over 300,000 square miles, was in pre-historic times joined to the Australian continent, from which it is separated by the Torres

Strait, about 90 miles wide. On the north-west are the Moluccas.

History.—New Guinea was discovered early in the 16th century by the Portuguese, and was given its name by Ortiz da Retez, who thought the inhabitants resembled those of the Guinea Coast in Africa. In 1793 the British East India Company formed a settlement on an island off the north-west coast, but in 1814 gave way to the prior rights of the Dutch, who in 1848 annexed all the western part of the island, containing about half of the whole. In 1884 the rest was divided between England and Germany, the latter taking a strip on the north which is known as Kaiser Wilhelm's Land. The sovereignty of the Crown was not proclaimed over British Guinea till 1888, when Sir W. Macgregor was made administrator. The expense of governing it is shared between New South Wales, Victoria, and Queensland. Port Moresby is the only station of importance. Dutch New Guinea is under the Residency of Ternate, and the German New Guinea Company administers Kaiser Wilhelm's Land.

Physical Features, Productions, etc. The island consists of a central mass sloping from north-west to south-east, with peninsulas at each extremity. Geelvink Bay is an inlet on the north-west, and the Gulf of Papua on the south-east. An almost continuous range of mountains traverses the island and is concentrated into several peaks at the south-east. The Fly, in British Guinea, the Empress Augusta in German, and the Amberno in Dutch territory, are the chief rivers. The climate is hot and very moist, and the prevalence of fever renders New Guinea difficult to live in for Europeans. The flora resemble the Asiatic rather than the Australian type. The cocoa-nut, banana, mango, and sugar-cane flourish, and some European trees—such as the oak and cedar—are not uncommon. The fauna, however, is of the Australian type. Kangaroos and other marsupials abound. Characteristic species are a peculiar kind of python, three kinds of ant-eaters, and the bird of paradise.

New Hampshire, one of the New England states, is situated between Maine and Vermont, having Massachusetts on the south. Of the latter state it for many years formed part, but latterly had a governor of its own. The first settlements were made as early as 1623. It was active during the American Revolution, and in 1784 adopted a state constitution. New Hampshire has an area somewhat larger than that of Wales. Its climate is healthy, and the scenery very beautiful. In the north are the White Mountains, the highest peak of which, Mount Washington, is more than 6,000 feet high. Other peaks are named from the Presidents of the United States. The chief rivers are the Connecticut, the Piscataqua, and the Merrimac, the last of which furnishes an important water-power. Winnepesaukee is a large lake. A large part of the land is still forest, and there is little agriculture; but the manufactures of the state are important. The chief towns are Dover, Manchester, and Nashua. New Hampshire elects a governor every two years,

who appoints the judges. It sends at present two members to Congress.

Newhaven, a port in Sussex 8 miles east of Brighton, has a Norman church and a large modern fort. Steamers run between it and Dieppe on the French coast.

New Haven, the chief port of Connecticut, stands at the head of a bay 4 miles from the nearest point on Long Island. It was settled in 1638 by some London merchants, and until 1662 formed a separate colony. This beautiful city is now an important manufacturing town, where all kinds of hardware, cutlery, and india-rubber goods are made. Among its educational institutions are Yale College, the Hopkins Grammar School, the Sheffield Scientific School, and upwards of thirty smaller schools. With Hartford it is the joint capital of Connecticut.

New Hebrides, a group of islands in the South Pacific, lying to the W. of the Fijis and N. of New Caledonia. Of the twenty inhabited islands Espiritu Santo, Mallicolo, Vate, Erromango, Ambryme, and Aneityum are the largest. The New Hebrides were discovered by the Portuguese in 1606, and explored by Captain Cook in the following century. They are a bone of contention between England and France, but neither has as yet occupied them. The people are cannibals, but some attempts have been made by missionaries to civilise them. Tropical products flourish, and whales are taken on the coasts, but some of the fish are poisonous. The climate is temperate and healthy.

New Jersey, one of the United States of America, has New York as its northern, and Pennsylvania as its western boundary. On the south it is separated by Delagoa Bay from Delaware. The total area is 7,576 square miles, and the coast-line is nearly 500 miles in extent. The first settlement was made at Bergen by the Dutch in 1617. The struggle for the possession of the Delaware country went on between them and the Swedes and English during the succeeding years, but the last-named finally obtained possession of the country. In 1664 James, Duke of York, who had received a grant, regranted it to Lord J. Berkeley and Sir George Carteret, one condition of the grant being the assumption of the name New Jersey. The number of proprietors afterwards increased, and in 1702 the interests of good government necessitated a surrender of governing privileges to the Crown. Even after this quarrels were frequent between the Governor and the Assembly. The state is mountainous in the north, and is extremely well watered. The Delaware flows along the whole length of its western border. On it stand the towns of Trenton, the capital, and Camden. The largest towns in the state are Newark, Jersey City, and Paterson. The chief industries are the boot-and-shoe manufacture, the silk manufacture, and the leather and machinery trades. Agriculture also flourishes, as well as fishing and mining, and the sea-coast is lined with health-resorts. New Jersey sends now seven representatives to Congress.

New London, a town of Connecticut on the west bank of the Thames. It was originally known as Pegmot Harbour. During the American War it was the headquarters of the Connecticut privateering fleet, and in 1781 was captured and burned. It is now a fashionable summer watering-place. Formerly it was a whaling port, and is now engaged in sealing and fisheries.

Newman, FRANCIS WILLIAM, author of *Phases of Faith*, and younger brother of Cardinal Newman, was born in 1805. He gained a double first at Oxford, but in 1830 resigned his Balliol fellowship from conscientious motives, and travelled in the East for several years. In 1846 he was appointed professor of Latin in London University, and held that post for seventeen years. Chief among his numerous writings are: *The Soul: its Sorrows and Aspirations* (1849), *Phases of Faith* (1850), *Theism: Doctrinal and Practical* (1858), *A Dictionary of Modern Arabic* (1871), and several classical translations and other works in various departments of learning.

Newman, JOHN HENRY, CARDINAL (1801-90), was born in London, where his father was a banker. He was educated at Trinity College, Oxford, where his career was shortened by his father's failure. In 1822 he was elected fellow of Oriel. Ten years later he went on a Mediterranean tour with Hurrell Froude, during which he nearly died of fever and wrote his hymn, *Lead, kindly light*. On his return he joined the Tractarian movement, of which he immediately became one of the chief leaders. Newman was the writer of the famous *Tract XC.* published in 1841. Two years after this he resigned the vicarage of St. Mary's, Oxford, which he had held since 1828, and in October, 1845, he was received into the Roman Church. At the end of 1846 he went to Rome, and in 1849 established a branch of the Oratorians in England. The last half of his life was passed at Edgbaston, near Birmingham, in great retirement. In 1879 Newman was made a cardinal deacon. The best known of his writings is the *Apologia pro Vita Sua*. He also wrote a poem, *The Dream of Gerontius* (1865), and a romance *Callista*, as well as a story, *Loss and Gain*.

Newmarket is fourteen miles north-east of Cambridge, on the border of Suffolk and Cambridgeshire. Races have been held on Newmarket Heath since the beginning of the 17th century; and there are now seven meetings here every year.

New Mexico, one of the most southern portions of the United States, lies between Texas and Arizona, and has Colorado on the north and Mexico and Texas on the south. Its area is 122,580 square miles, but it is very thinly populated. Parts of it were early settled by the Spaniards, who retained it till the revolt of Mexico in 1822. The present territory was formed out of the district ceded in 1848 by Mexico after her war with the United States and of subsequent purchases from her, part of which was afterwards detached to form Arizona (q.v.). There are still many Mexicans in the country. New Mexico is extremely mountainous, the chains generally running north and south. Forests clothe

the summits; but there are large grass plains, on which sheep and cattle are pastured in great numbers. The Rio Grande flows northwards through the middle of the State, and is joined by the San Jose, which rises west in Arizona. The Pecos, another large stream, takes a southerly course into Texas. The climate is one of the best in the world, and the rainy season is short. Stock-raising and mining are the chief industries, and in the river valleys good crops are obtained. All kinds of metal abound, and there are also coal-fields. The chief towns are Santa Fé (one of the oldest places in America), Albuquerque, and Fernandez de Taos. A bill for its admission as a State was before Congress in December, 1893.

Newnham College, a women's college at Cambridge, is composed of the Old Hall, Sidgwick Hall, and Clough Hall, presided over by a lady principal and two vice-principals. Newnham Hall was built in 1875. Newnham has a library, a laboratory, and gymnasium, and is well endowed with scholarships.

New Orleans, one of the largest cities in the United States, in the state of Louisiana (q.v.), on the left bank of the Mississippi, 105 miles from its mouth, situated on ground several feet below the highest level of the river. A basin and canal connect the city with the bay of St. John, Lake Pontchartrain, etc., so that there are two channels between the port and the Gulf of Mexico. The port carries on a large export trade for the vast extent of country drained by the Mississippi and its affluents; but, as much produce is brought down in flat-bottomed vessels which do not return, the imports are not nearly so large as the exports, which comprise cotton, corn and flour, tobacco, pork and lard, fruit and timber. The old city, built to a great extent of brick faced with stucco in the French and Spanish style, is an oblong, extending about 1,300 yards along the "levée," or dyke, which keeps out the flood-water of the river, with a width of about 700 yards. The "faubourgs," or suburbs, above and below the old city, are more American in style. The population contains a considerable coloured element and a large percentage of inhabitants of French and Spanish descent. The Roman Catholic cathedral is a large and striking edifice. The city was formerly very unhealthy owing to the low and marshy nature of the surrounding country, but drainage has effected great improvements in the sanitary condition. There are a flourishing university and many magnificent public buildings.

Newport. 1. A municipal borough of Monmouthshire, forming with Monmouth and Usk a parliamentary borough, is situated on the Usk, four miles from its mouth. It has a large shipping trade, exporting coal, iron, and manganese. The principal manufactures are brass and iron, indiarubber and guttapercha, and railway and telegraph plant. The church of St. Woollos and the town hall are fine buildings.

2. The capital of the Isle of Wight, on the Medina, situated near the centre of the isle, is a municipal borough. It has a fine church containing the monument, by Marochetti, raised by Queen Victoria

to the memory of the Princess Elizabeth. There are also a free grammar school, barracks, and a reformatory.

New Red Sandstone, a name at one time generally applied in England to those red sandstones, breccias, loams, and limestones which overlie the coal-measures or other carboniferous rocks, generally unconformably. They were termed "new," as being newer than the coal-bearing beds, in contradistinction to the Old Red Sandstone (q.v.), which is older than those beds. Though largely reddened by iron oxide, their other bright tints gained for them the name of *Poikilitic* ("variegated"); but the work of Murchison and his colleagues showed that they are made up of two distinct series—one, now known as *Permian* (q.v.), showing more affinity in its fossils to the underlying Palæozoic rocks, and the other, now known as the *Trias* (q.v.), similarly more closely related to the overlying secondary rocks. Though in England no marked boundary line can be drawn between these two series, elsewhere they are often unconformable.

Newry, a municipal and parliamentary borough and port of Ulster, situated on the river Newry, in Carlingford Bay, and on the Dublin and Belfast Junction Railway. It is well laid out, and has several fine churches, a nunnery, and a large iron and brass foundry. The majority of the inhabitants are Roman Catholics.

New South Wales, a flourishing British colony, extending along the east coast of Australia from the river Tweed, lat. 28° 10' S., to Cape Howe, lat. 37° 31' S., with a varying breadth of about 500 miles on the average. It is bounded by Queensland (separated from it in 1859) on the north, South Australia on the west, and Victoria on the south. The Blue Mountains and Australian Alps form a mountain range stretching from north and south from 30 to 50 miles from the coast, the western slope being watered by several fine tributaries of the river Darling and river Murray. On the coast there are a number of fine natural harbours, of which the principal are Port Macquarie, Port Stephens, Port Hunter, Broken Bay, Port Jackson, Botany Bay, Jervis Bay, and Bateman Bay. The rivers Hastings (flowing into Port Macquarie), Hunter, Hawkesbury (into Broken Bay), Paramatta, the Shoullhaven and Clyde (into Bateman Bay) are more or less navigable. The chief towns are Sydney (q.v.) and Bathurst. There is much fertile land, producing cereals, fruit, wine, and livestock, while the mineral riches include gold, copper, coal, and marbles.

Newt, any species of the genus *Triton*, Tailed Amphibians of the same family as the Salamander (q.v.). Wallace admits sixteen species, from Europe, except the extreme north, Algeria, North China, and Japan, the eastern states of North America, California, and Oregon. The body is covered with warty tubercles, and there is a series of glandular pores along the lateral line. There are four fingers and five toes, and the male has a back and tail crest, the two being sometimes continuous. These ornaments are most conspicuous

during the breeding season. These animals frequent ponds and ditches, sometimes leaving the water for the damp marshy ground on the banks. They prey on worms, insects and their larvæ, water-fleas, etc., and even on weaker animals of their own kind. The eggs are attached to water plants, and the young undergo a metamorphosis resembling that of a frog, though a newt tadpole is a beautiful little creature, which cannot be said of the frog tadpole. Six weeks is said to be the normal duration of the metamorphosis; but this supposes a good supply of food, for it may be greatly prolonged by keeping the newt larvæ on low diet. Three species are British. The Crested, or Great Water Newt (*T. cristatus*), is about six inches long, dusky above, with some spots on the side; the under-surface bright orange dotted with black. This species seldom leaves the water when at liberty. The Common Smooth Newt (*T. punctatus*) is between three and four inches long; brownish above, and orange, with dark marking, on the upper surface. The Palmated Smooth Newt (*T. palmipes*) has the digits of the hind limbs webbed. If newts are kept in an aquarium, an island—of virgin cork—should be provided for them, and the tank must be kept covered, as these animals have an awkward habit of getting out, and when they have made their escape they generally creep into some corner and die.

Newton, SIR ISAAC (1643–1727), the son of the owner of Woolsthorpe Manor, in Lincolnshire, where he was born, an exceptionally puny infant, was educated at the village school and at Grantham. He gave early indications of the tastes and talents which rendered him the greatest philosopher and mathematician of modern times. His father having died in his infancy, his mother soon removed him from school to help her with the farm, but after a time he was allowed to return to Grantham, whence he proceeded to Trinity College, Cambridge (1660), where he attended Professor Barrow's lectures and, by private study, carried on Wallis's researches, and discovered his binomial theorem, while by the end of 1664 he had discovered the method of fluxions. In 1665 he was driven from Cambridge by the plague, and while at Woolsthorpe he discovered the law of gravity. In 1666 he was elected a fellow of Trinity College, and discovered the composite nature of light. In 1672 he became a fellow of the Royal Society, and became involved in a controversy on his discoveries. He published his great *Treatise on Optics* in 1704, having already, in 1686, finished his *magnum opus*, *Philosophiæ Naturalis Principia Mathematica*. In 1688 he became member for the university of Cambridge. In 1692 the results of several years' studies in chemistry were destroyed owing to his pet dog overturning a lighted candle, which lamentable accident seriously affected Newton's health and energy. In 1696 he was appointed Warden of the Mint, and rendered great service in the calculations and experiments required for the general recoinage, and in 1699 he became Master of the Mint. Newton held the Lucasian professorship of mathematics in the university of Cambridge from 1669 to 1702, and was for some time M.P.

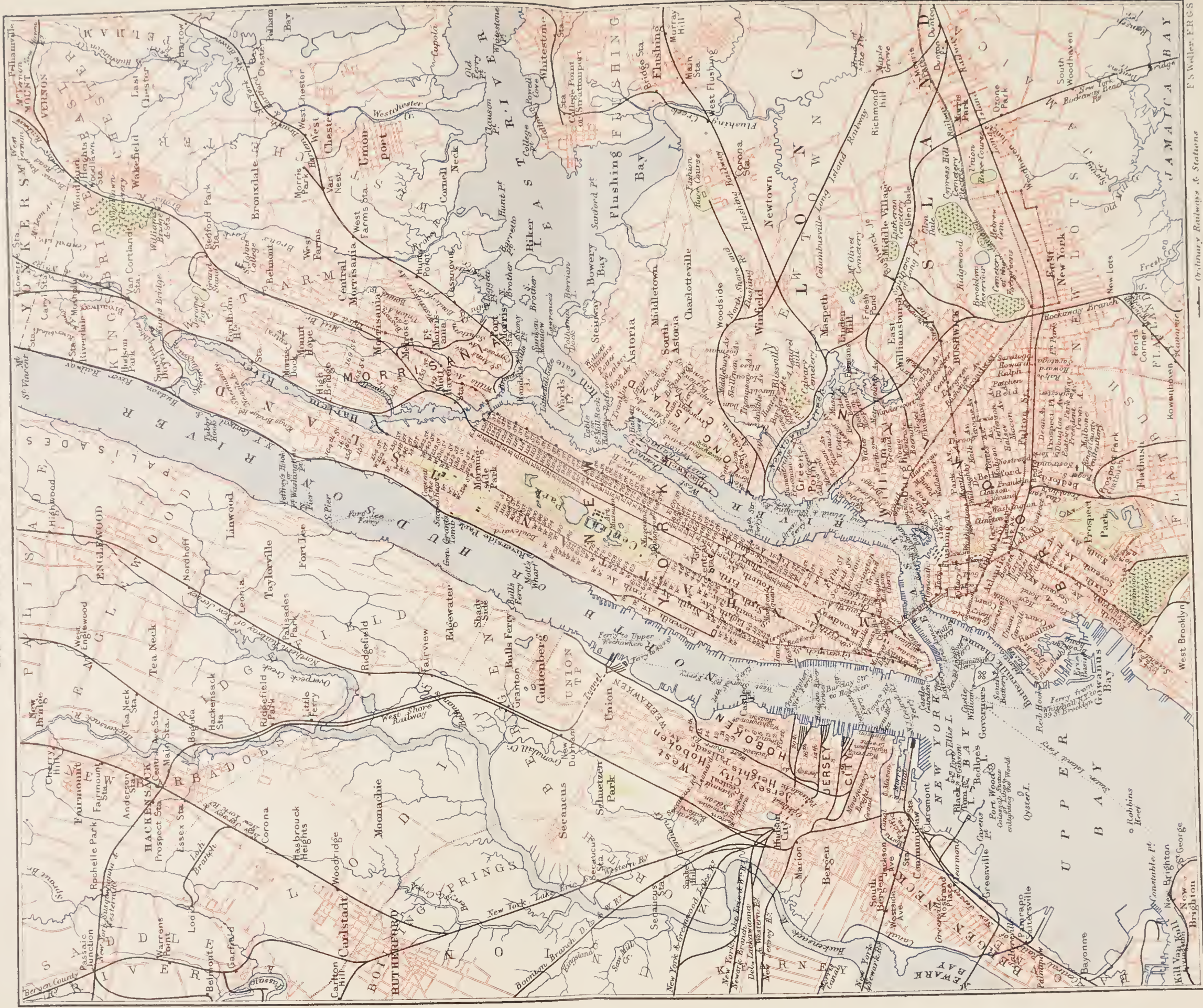
for Cambridge. He was elected President of the Royal Society in 1703, and in 1705 was knighted. Though he gave up science for the last ten years of his life, he remained in good health until his eightieth year, after which he gradually succumbed to the stone. His other published works include *Arithmetica Universalis* (1707 and 1712), *Analysis per Equationes Numero Terminorum Infinitas* (1711), and *Methodus Differentialis*. He was buried in Westminster Abbey, and his statue by Roubiliac stands in Trinity College Chapel. For the controversy with Leibnitz (q.v.) Newton was not at all responsible, but was at last forced to defend his claim to priority in the discovery of the principles on which were based his method of fluxions, and Leibnitz's. [CALCULUS, DIFFERENTIAL AND INTEGRAL.]

Newton, JOHN (1725–1807), born in London, after attending school at Stratford for two years, went to sea and was concerned for some time in the African slave trade. He then turned his attention to religion, gave up the sea and, while a tide-waiter at Liverpool, prepared himself for ordination. He eventually became curate of Olney, where he became the intimate friend of the poet Cowper and the philanthropist John Thornton, the latter of whom, in 1779, presented him to the living of St. Mary Woolnoth. His earnest preaching and devout conversation had a great influence on the leaders of the Evangelical movement, and, both by evidence before Parliament and by earnest advocacy, he contributed to the eventual abolition of slavery. Mr. Newton contributed to the *Olney Hymns*, published by Cowper in 1776, and his published works include an *Autobiography*, *A Review of Ecclesiastical History*, *Cardiphonia*, and *Letters of Omieron*.

Newton's Rings. Beautiful colours are observed in soap bubbles, and a similar effect is produced by a thin film of any liquid: when, for instance, a pane of glass is wetted and then rubbed almost dry, or when a drop of oil spreads itself out on the surface of water. When two pieces of glass are pressed together a thin film of air separates them, and coloured rings surround the point of closest contact, the colours of these rings varying as the distance from that point is increased. Newton was the first to carefully investigate these phenomena; hence they are known as Newton's rings. The production of these colours is due to the fact that interference occurs between light reflected from the upper surface and that reflected from the lower surface of the film. This interference causes the destruction of different-coloured light at different points, and as the light which originally entered the film was white, the colour which is seen by the eye is complementary to the one which is destroyed.

New Year's Day, the first day of the civil or calendar year and of the month of January; it is the Feast of the Circumcision, kept as holiday in the Christian countries of the European continent, but where the Greek Church prevails it falls twelve days earlier than with us. [CALENDAR.]

NEW YORK AND ENVIRONS



English Miles



London Cassell & Company Limited.

— Ordinary Railways & Stations
— Elevated
--- Township Boundaries

ES Weller: ERCS

No matter how the year be reckoned, New Year's Day seems always and generally to have been observed as an occasion for congratulations and good wishes and for the interchange of presents.

New York City, the largest port and city of the United States, is situated on the Hudson river, where it falls into New York Bay, and on Manhattan Island. The principal suburbs are Brooklyn and Williamburg beyond East river (between New York Bay and Long Island Sound), and west of the Hudson, Jersey City and Hoboken. The oldest part of the city is irregularly built, but the newer and larger part of the city is laid out on a regular plan—avenues a hundred feet wide running north and south, and streets almost as wide running at right angles to them, most of the avenues and streets being designated by numbers. The principal streets are Broadway, the main thoroughfare lined with splendid public buildings, theatres, hotels, stores, etc.; the Bowery, on the east of the Broadway; Wall Street, containing fine public buildings and the great financial centre, and Fifth Avenue, bordered mainly by the residences of millionaires. The harbour is one of the finest in the world. Staten Island and Long Island divide Raritan Bay, the outer harbour from the inner harbour. The largest ships can get up to the vast extent of wharves. The City Hall is a splendid edifice, finely situated in the beautiful Central Park. The Merchant's Exchange (Wall Street) and the Custom House (Broad Street) are also very handsome buildings. From numerous public institutions we may select for mention Columbia College, the University of New York, the Cooper Institute, and the Astor Library. Altogether New York is a handsome and attractive city, where money can command unlimited comfort and luxury, though sometimes the fumes from the numerous oil refineries round the city make the atmosphere unpleasant. The name was originally New Amsterdam, as it belonged to the Dutch until 1664, when it was taken by the English and, with surrounding country, granted by Charles II. to James, Duke of York, and the States General gave up their rights at the treaty of Breda in 1667.

New York State, one of the thirteen original states of the American confederacy, is bounded on the north-west and north by Lake Erie, the river Niagara, Lake Ontario, the river St. Lawrence, and Canada, on the east by Vermont, Massachusetts, and Connecticut states, and by the Atlantic (Long Island being part of the state), on the south by New Jersey and Pennsylvania, which state also bounds it on the west. Most of the country consists of elevated ground or mountains divided by basins or valleys, notably by the valley of the Hudson and Lake Champlain and that of the Mohawk river and Oneida lake. East of the Hudson Valley rises a range of mountains, some of the peaks reaching of 6,000 feet, which includes the beautiful highlands the Adirondacs (q.v.). West of the Hudson rise the Catskill Mountains and other parallel ridges, which are northern continuations of the Alleghanies. These ridges divide several fertile valleys, while several rivers flow through fertile valleys down the

great slope toward Lakes Erie and Ontario. The state contains numerous lakes besides those mentioned. The navigable lakes and rivers are connected by several canals, and the state is also well furnished with railways. [For the more important cities and towns *see* ALBANY, NEW YORK CITY, BUFFALO, DUNKIRK, GENEVA, SARATOGA.]

New Zealand consists principally of three islands, North Island (with an area of 44,500 square miles), South Island (with an area of 54,100), and Stewart Island (with an area of only 900 square miles). North Island is much indented, and has several ranges of mountains; South Island has one main chain, the Southern Alps, which, in Mount Cook, reaches 12,349 feet. The principal rivers, the Waikato, Wanganui, and Manawatu are in North Island, the streams in South Island being all small. The inhabitants consist of English and Scotch colonists and of Maoris, the original inhabitants, who are, however, fast dying out. The products include cereals, sheep, and minerals, and platinum. Till 1875 New Zealand was divided into provinces, but it was then divided into counties. Among the towns we may mention are Wellington, New Plymouth, and Auckland (q.v.) in the North Island, and Nelson, Christchurch (q.v.), and Dunedin (q.v.) in the South.

Next of Kin, of a deceased person, those who are next in degree of kindred, but frequently the term is used to signify those who are entitled to the personal property of any one who has died intestate. If a widow and children are left, the widow takes a third and the children two-thirds. [CONSANGUINITY.]

Ney, MICHAEL, MARSHAL OF FRANCE, DUKE OF ELCHINGEN, PRINCE OF MOSKWA (1769–1815), born at Sarre Louis, of humble origin, entered the army as a private hussar, was rapidly promoted by General Kleber, and in 1796, at Rednitz, was made general of brigade. He distinguished himself at Neuwied (1797). As general of division he commanded on the Rhine in 1799, and helped Massena to defeat the Russians at Zürich. Ney then distinguished himself under Moreau. In 1805 Napoleon made him Marshal of the Empire and also Duke of Elchingen after his defeat of the Austrians at that place which led to the capitulation of Ulm. He commanded the third division of the Grand Army which invaded Russia, and at the battle of the Moskwa Napoleon hailed him "as the bravest of the brave," and gave him the title of the Prince of Moskwa. His conduct during the retreat from Moscow afforded the most striking instances of his genius and bravery. In 1813 Ney marched to Berlin, but was defeated by Bülow. He fought with distinction at Leipzig and Hanau and while contesting the advance of the allies into France. On the capture of Paris (March 31, 1814) Ney advised Napoleon to abdicate, and, upon the Bourbon restoration, took the oath of allegiance to Louis XVIII. and received a high command in the army. On Napoleon's return Ney marched against him with a considerable force; but, finding that his troops were in favour of Napoleon, Ney joined him at Lyons, and

commanded the French left at Quatre-Bras and led the attack on the English centre at Waterloo. He fled to Paris, announced that all was lost, and went into hiding, but was discovered, tried, and shot.

Nez Percés, a Franco-Canadian term applied to a large North American nation of the Columbia basin who appear to have no collective national name, but who are now commonly known as Sahaptins, or Shahaptins, from a Salish (Flathead) word of unknown significance. They occupied a wide domain along the Columbia and its affluents as far west as the Cascade Mountains, east to the Bitter Root Mountains, north to about 46°, and south to lat. 44° N. Chief tribal divisions: Chopunish, Klikitat, Paloos, Tenaino, Tyigh, Umatilla,

Island. The total breadth of the Falls is nearly three-quarters of a mile. They are $22\frac{1}{2}$ miles below Lake Erie. Niagara river is 37 miles in length, with a fall of 334 feet.

Niam-Niam (properly *A-Zandeh*), a large and, till lately, a very powerful Negro nation, south-east Sudan, on the northern affluents of the Welle and generally about the Nile-Congo and Congo-Chad water-partings. The term Niam-Niam applied to them by the Dinkas means "Great Eaters," and is so intimately associated with the idea of anthropophagy that it has been extended to many other peoples of Central Africa who have no connection with the A-Zandeh beyond their common cannibalism. Despite this universal practice, they are a



CITY OF NEW YORK, FROM BROOKLYN HEIGHTS

and Walla Walla; total population (1890) about 3,000, all now distributed amongst the Nez Percé, Yakama, Warm Springs, and Umatilla Reservations of Idaho, Washington, and Oregon respectively.

Ngami, a lake in the interior of South Africa, long. 20° 40' E., lat. 20° 40' S., about 300 miles west of Mashonaland. At its most northerly point it receives the river Embarras from the north-west, and is drained by the river Zonga on the east. The Zonga gradually dwindles for about 250 miles, and then spreads out into a lagoon, and is lost in the sands and by evaporation.

Niagara Falls, the stupendous cataract down which the NIAGARA RIVER, which flows from Lake Erie to Lake Ontario, precipitates itself over a limestone ledge 137 feet high on the Canada side, and 150 feet on the New York side. For about 300 yards above the Falls the river is divided into two channels by a narrow island called Goat

remarkably intelligent people, who had developed an orderly system of government and established a hereditary monarchy with numerous vassal states in the Welle region probably 200 years ago; but during the latter half of the present century the Zandeh empire crumbled to pieces partly through dynastic wars, partly through intrigues and open attacks of the Arab slave-hunters. Since the Mahdist revolt several princes of the royal house have set up separate petty states, which have accepted the protectorate of the Congo Free State. Their domain comprises altogether about 50,000 square miles with a collective population of over 2,000,000. The type—round head, broad features, oblique eyes set far apart, dark reddish complexion, long ringletty hair—is so marked that a Niam-Niam can be instantly distinguished from any other native of Africa. The men occupy themselves chiefly with hunting and fighting, while the women till the fields and do most of the hard work. Their

weapons are the spear, shield, and cutlass, and much skill and taste are displayed in the production of iron and wood utensils, baskets, earthenware, drums, pipes, and the like. (Miani, Schweinfurth, Junker.)

Nibelungs, or NIFLUNGS, a mythical princely race which furnished the title of the great German epic, the *Nibelungenlied*. They were vanquished and despoiled of their vast treasures by the hero Siegfried, who wins as his bride Chriemhild, sister of Gunther, King of Burgundy, by overcoming for Gunther the amazon Brunhild of Iceland. Brunhild quarrels with Chriemhild, and persuades Hagen of Tronege to murder Siegfried, Gunther being privy to the crime. Chriemhild then marries Etzel [ATTILA] of Hungary, invites the Burgundians to Etzel's court, and brings about a war between them and the Huns from which none save Gunther and Hagen escape alive; these are captured by Dietrich of Berne, and put to death by Chriemhild, revenge being completely triumphant.

Nicaragua, a republic of Central America, extending from the Caribbean Sea to the Pacific, between Honduras on the north and Costa Rica on the south. Thirteen miles from the Pacific Ocean, about 25 miles south of the capital, Leon, is the lake Leon, from which a short river leads to Lake Nicaragua, 90 miles in length, which is drained by the river San Juan into the Caribbean Sea at Grey Town or San Juan, the principal port of the state. Cattle are raised on extensive pastures to the east of the lakes, and most of the country is very fertile. Large tracts of forest yield gums and dye-woods. Silver and gold are found.

Nice (NIZZA), the chief town of a district of the same name, is beautifully situated on the Mediterranean. It belonged till 1860 to the kingdom of Sardinia, but was then ceded to France. The principal places of interest are the fortified port and the ruins of the old Roman amphitheatre. The old part is dark and squalid, while the new part has good buildings and streets, and is famed for its good air. The manufactures include tobacco, liqueurs, silk thread, and perfumery.

Nicene Creed, the creed formulated at the first council of Nice, and afterwards added to (the *Filioque* clause), in 381 A.D. It is recited daily in the Mass of the Roman Catholic Church, and in the Communion office of the Anglican Church.

Nicholas, the name of six Roman Popes, the chief of whom are NICHOLAS I. and II.

Nicholas I., surnamed THE GREAT, a Roman by birth, was pontiff from 858 to 867. He was very energetic and ambitious; in 863 he excommunicated Photius of Constantinople, and thus caused the separation between the Eastern and Western Churches. He first founded the claims of the Papacy to universal temporal power on the spurious decretals of Isidore, subjected Lotharius I. to penance, and converted Bogoris of Bulgaria, with his people. In the Roman Church he ranks as a saint.

Nicholas II., born at Chevron, in Savoy, formerly Bishop of Florence, was pontiff from 858

to 867. He did much to establish the power of the Papacy by giving the election of pope to the cardinals and by introducing clerical celibacy. He found a stout champion in Robert Guiscard, Duke of Normandy, who defended his temporal possessions in lower Italy.

Nicholas I., PAULOVITCH (1796-1855), Emperor (Tzar) of Russia, was the third son of Paul I. In 1816 he visited England, and in 1817 married Charlotte, eldest daughter of William III. of Prussia. In 1825 he succeeded his eldest brother, Alexander I., passing over his elder brother Constantine. This gave rise to a slight mutiny in the army, which Nicholas quelled, and then began a reign of despotism and conquest. Provinces and countries were annexed and ravaged—notably Poland and Hungary—and he kept encroaching on Persia and Turkey till it seemed as though Constantinople was in his grasp. France and England, however, forced him to withdraw his army from the Danubian provinces and invaded the Crimea in 1854. The crushing defeats which he then received broke his spirit, and he died in 1855, and was succeeded by Alexander II.

Nicholson, JOHN (1822-57), a celebrated Indian soldier, was born in Dublin, and, when fifteen, entered the service of the East India Company. During the campaign of the Sutlej he greatly distinguished himself, being present at the battle of Ferozeshah. He was then appointed assistant to the Resident at Lahore, and later Deputy-Commissioner of the Punjab. In the Mutiny (1857) he suggested and helped to organise the famous movable column, and dealt with great success with the suspected Sepoy regiments. At Trimmoo Ghaut and Majafgarh he annihilated rebel forces, and led the first column, as Brigadier-General, at the siege of Delhi, where he fell. Some of the natives made him an object of worship.

Nicias (d. 413 B.C.), son of Niceratus, a distinguished Athenian war minister and general, a supporter of Pericles and afterwards the opponent of Cleon and Alcibiades. He was very superstitious and cautious, yet was generally successful in military and naval operations, though his successes were not very important. He succeeded in bringing about a peace in 421 B.C. War, however, was soon resumed. Nicias opposed the expedition to Sicily in 415, but when it was agreed upon he accepted the command with Alcibiades and Lamachus. On the death of Alcibiades, Nicias became practically sole general, and in 414 was on the point of capturing Syracuse when the Spartan Gylippus came to the rescue, with the result that, though Demosthenes brought Athenian reinforcements in 413, the Athenians were utterly defeated in that year. Nicias's blunders drove them to surrender, whereupon Nicias and Demosthenes were put to death by the Syracusans. It is fair to say that Nicias, owing to broken health, had, in 414, asked to be relieved of his command.

Nickel-Steel. It was discovered in 1888 that the addition of a small percentage of nickel to steel greatly increases its hardness and tenacity;

and this fact was at once taken advantage of for the making of ship's armour. The plates offer, roughly speaking, about 20 per cent. greater protection than the best simple steel plates of the same thickness, and they have since been very generally adopted as the materials for the thinner armour, and for the protective decks of men-of-war. They are further hardened and toughened by various processes, among which those of Harvey and Tressider are the most successful.

Nicobar Islands, a group of nineteen islands in the Bay of Bengal, north-west of Sumatra. The dense forests yield teak, plantains, and cocoas, but make the climate detrimental to Europeans.

Nicolai, CHRISTOPHER FREDERIC (1733-1811), a bookseller and author, a native of Berlin, is chiefly distinguished for his criticisms on German literature. He laboured, in co-operation with Mendelssohn and Lessing, to reform the national taste. His greatest critical work, the *General German Library*, appeared in 1765. He underrated Goethe and attacked Kant.

Nicolaief. [NIKOLAIEFF.]

Nicolas, ST., Bishop of Myra, in Lycia, flourished towards the end of the fourth century A.D. He was famed for his charity. He became the patron saint of Russia and of the Dominican order, and the patron of virgins and sailors, and, perhaps in some quarters, of robbers.

Nicolas, SIR NICHOLAS HARRIS, was born at Looe, in Cornwall, in 1799. He became a lieutenant in the navy at the early age of sixteen, but being unable, after the peace, to obtain employment in the service, he was called to the bar in 1825, and subsequently obtained the appointment of secretary to the Knights Commanders and Companions of the Bath and Chancellor of the Order of St. Michael and St. George, of which, in 1840, he was made a Knight Grand Cross. He is chiefly remembered for his numerous and learned literary works, among which may be noted his edition of Lord Nelson's *Letters and Despatches*, and his unhappily uncompleted *History of the Royal Navy*; he was also a distinguished inventor, and made several improvements in telegraphy and in marine signalling. He died in 1848.

Nicol's Prism is an instrument for polarising light or for analysing it when polarised. It is made by cutting a piece of Iceland spar in a particular diagonal plane and after polishing the cut surfaces sticking the two halves together again by means of Canada balsam. The Canada balsam has such an index of refraction that the ordinary ray is totally reflected, and only the extraordinary ray passes through the prism. To understand the action of a Nicol's prism some knowledge of polarisation and double refraction is needed.

Nicotine ($C_{10}H_{14}N_2$) is a poisonous alkaloidal substance which occurs in the leaves of the tobacco plant, from which source it may be obtained. It is a colourless oily liquid, soluble in most organic solvents and in water, which it readily absorbs from the atmosphere. It turns brown on exposure to air,

and decomposes if boiled. It acts on polarised light, being levorotatory. It possesses a burning taste, and is very poisonous. The presence of nicotine in tobacco smoke has been asserted and denied by different chemists. Its constitution is given by the formula $C_5H_4N \cdot C_5H_{10}N$, i.e. is hexahydro-dipyridyl.

Niebuhr, BERTHOLD GEORGE (1776-1831), the celebrated historian of ancient Rome and classical scholar, was born at Copenhagen while his father, a distinguished German engineer, was in the Danish service; but in his second year he was taken to South Ditmarsh. in Germany. After acquiring some knowledge of commerce at Hamburg, and studying law at Kiel, he went, in 1795, to Edinburgh to study natural science for a year and a half, and then, after travelling in England for half a year, he obtained high financial appointments in Copenhagen. In 1806 he entered the Prussian service, and took an active part under Stein (q.v.), in the re-establishment of Prussian affairs. In 1810 he lectured on Roman history in the new university of Berlin, and in the two succeeding years published the first two volumes of his Roman history. These he recast from 1827 to 1830. The third volume he left unfinished. The most important of his many contributions to classical scholarship are his discovery in Verona of the *Institutions of Gaius* (1816), and his edition of unedited fragments of the works of Cicero and of Livy (1820).

Niello, a kind of damascening practised by the Romans, and revived in Italy in the fifteenth century. Holes and grooves were chased in metal and other materials, and filled in with an alloy of silver and lead.

Niepce's Process was one of the earliest of photographic processes, being first invented in 1813. By exposing a copper or other metal plate covered with asphalt or bitumen to light in the camera, the portions where the light acted were rendered insoluble; and when the rest of the compound was dissolved away by a suitable solvent, these parts stood out in relief. The plate was then used for printing from or etched by acid and employed thus for reproduction.

Nièvre, a department of France bounded north by Yonne, east by Saône-et-Loire and Côte-d'Or, south by Allier, and west by Cher, its capital being Nevers (q.v.). A great part of its surface is occupied by wood and mountain. Its principal products are iron, coal, and other minerals.

Niger, a large river of western Africa, which rises in the Kong Mountains on their northern slope, and, flowing to the north-east past Timbuctoo, then turns south-east, and, after being joined by the Tchad'da (which flows from the east), passes through a gap in the Kong range, and discharges its waters into the Gulf of Guinea.

Night-Heron, any bird of the cosmopolitan genus *Nycticorax*, with nine species closely allied to the Heron (q.v.), which it resembles in habit. The Common Night-Heron (*N. griseus*), which breeds in the south of Europe, has of late years

visited Britain. It is about two feet long, with bluish-grey plumage; a black patch runs from the crown to the middle of the back.

Nightingale, any bird of the Passerine genus *Daulias* of the Thrush family, with two species from Europe, western Asia, and north Africa. The Common Nightingale (*D. luscini*a) is nearly seven inches long; the plumage is alike in both sexes—rich chestnut-brown above, with a rufous tinge on the tail, greyish-white beneath, deepening in hue on the breast. These birds visit



THE COMMON NIGHTINGALE. (*Daulias luscini.a*.)

England, arriving about the middle of April, the males coming first by some days, and numbers are then taken by the bird-catchers. Birds captured thus do better in confinement than those trapped after pairing. Nightingales are locally distributed during their stay, chiefly in the south and east, a few ranging to the west, and to Glamorganshire and Brecknockshire, but they do not visit Scotland or Ireland. They frequent groves, small shady copses, woods, quiet gardens, and thick hedgerows, and feed on worms, insects, and insect-larvæ. The nest is made in a hollow in the ground, or in a low fork in a thick bush, and the eggs—olive-green in colour—are generally five in number. The song of the nightingale, which has been famous from the earliest times, and celebrated by poets of almost every land, is the love-song of the male, and ceases when incubation is over. The Thrush-Nightingale (*D. philomela*), a Continental species, is slightly larger, and has the breast spotted.

Nightingale, FLORENCE (b. 1820), devoted her advantages to philanthropy. She studied schools, hospitals, and reformatories for some time. After reorganising the governesses' sanatorium in Harley Street, she organised and supervised the ladies who volunteered as nurses in the Crimea. The public

testimonial subscribed in recognition of her most able and devoted services, amounting to £50,000, was expended at her request on the "Nightingale Home" for training nurses at St. Thomas's Hospital. She has been a leading authority on sanitation and therapeutics, and in 1859 published *Notes on Hospitals* and in 1860 *Notes on Nursing*.

Nightjar. [GOATSUCKER.]

Nightshade, the popular name of the English species of *Solanum*, the Woody Nightshade, and of the allied *Atropa belladonna*, the Deadly Nightshade. This latter is an erect, stout-branched, herbaceous plant, with large, ovate leaves, drooping, bell-shaped, luridly brownish-purple flowers, and black cherry-like fruits with a persistent green calyx. Its deadly narcotic properties are chiefly in the roots and leaves. [ATROPINE.]

Nihilism, in Russia, organised opposition to the established order of society and government; the principles and methods adopted by various secret revolutionary societies in Russia, some of which, however, have left the purely destructive position and become democratic and socialistic rather than merely anarchical. The more violent Nihilists or "terrorists" aim at upsetting the present system by mysterious and appalling outrages, such as the assassination of the Czar Alexander II. (1881). The term originally implied only negation of the principles generally accepted in *society* in Russia. In metaphysics, scepticism carried as far as the assertion that nothing really exists, has been called Nihilism.

Nijni-Novgorod, a town of central Russia, at the junction of the Oka with the Volga, is famous for its annual fair, the largest in the world, which lasts from July to September, and draws a vast concourse of people.

Nikolaieff, a fortified town and port of Russia, on the Black Sea, at the confluence of the Ingul and the Bug.

Nile, THE RIVER, the most important river of Africa, its course extending, from south to north, over more than half the entire length of the continent. Its source was for centuries unknown, and it is only lately that it has been ascertained that the main, or western branch, called the White Nile or Bahr el Abiad, flows from the large lake Victoria Nyanza, long. 33° E., lat. 30' N., the lake itself extending more than 200 miles south of the equator. The river flows by a sinuous course north-west, until it receives the waters of the lake Albert Nyanza, lat. 2° N. It then flows northward to Khartoum, receiving about half-way two large affluents—the Bahr el Ghazal, from the west, and the Sobat, from the east. At Khartoum it is joined by the western branch, the Blue Nile or Bahr el Azrak, which rises in Lake Dembea in the Abyssinian mountains. From Khartoum it flows north-east to the junction of the river Atbara, its most northern tributary. Then, with two great bends and many small ones, it flows in a succession of rapids and cataracts past Berber, Dongola, Wadi Halfa, and Korosko to Assuan, and then pursues a

northerly direction to the great delta through which it discharges itself into the Mediterranean, the chief channels issuing at Alexandria, Rosetta, and Damietta. The entire length of the main stream must exceed 3,000 miles. From Berber

the Nile flows through a valley which is almost rainless, but much of which is fertilised by the yearly inundations of the river.

Nilsson, CHRISTINA (b. 1842), the famous *prima donna*, was a labourer's daughter, born at Wederslöv, near Wexiö, in Sweden. As a young girl she sang to her violin at fairs, until in 1857 her powers attracted the notice of an enthusiast able to have her educated for the operatic stage. She appeared at Stockholm and Paris (1860), in London at Her Majesty's Theatre (1867), in the United States (1870). She married in 1872, became a widow in 1882, and married again in 1886.



MAP OF THE COURSE OF THE NILE.

Nimeguen, a city of Guelderland, in Holland, situated on a steep hill sloping down to the river Waal. Most of the streets are narrow, but there is a fine promenade called the *Kalverbosch*.

Nîmes, or NISMES, capital of the department of Gard, in France, 62 miles north-west of Marseilles. In the 16th century Nîmes was strongly Huguenot, and suffered accordingly, and many of the inhabitants are now Calvinists. It has many industries, especially the manufacture of silk and cotton, and a considerable trade in wine, oil, etc. It is chiefly famous for its Roman remains, especially for the fine temple to Venus.

Nimbus, in art, the halo or circle of rays round the head of a deity, angel, saint, or emperor. The pattern came to be varied; for instance, the nimbus of Christ contained a cross, of God a double

triangle, while that of a living emperor was square. The term is often confused with *aureola*, the rays of which surround the whole figure, and with *glory*, which is properly a combination of aureola and nimbus.

Nineveh, or NINUS, the capital of the Assyrian Empire, one of the most ancient cities of the world, was situated on the left bank of the Tigris opposite Mosul. Its foundation was mythically attributed to Ninus, husband of Semiramis (q.v.). In the ninth century B.C. the city was an oblong of 55 miles circuit, surrounded by brick walls 160 feet high, on which three chariots could be driven abreast, and it must have contained about 600,000 inhabitants. It was captured and destroyed by the Mede Cyaxares with the help of the Babylonians B.C. 606. The British Museum contains a splendid collection of antiquities and inscriptions excavated from the ruins of Nineveh by Mr. Layard (q.v.).

Ningpo, one of the treaty ports of China, on the east coast, on the left bank of Takia. It is an extensive walled city, situated in a fine plain. It manufactures silk and cotton goods and carpets.

Niobe, in Greek mythology, a daughter of Tantalus, sister of Pelops, and wife of Amphion, King of Thebes. Proud of her six sons and six daughters, she regarded Leto with contempt as the mother of only two children; whereupon the two, Apollo and Artemis, slew all Niobe's children with their arrows and turned the people of the land into stone, as well as Niobe herself, who was on Mount Sipylus. The tradition is partly founded on a rough representation of the figure of a weeping woman presented by a dripping rock on the mountain.

Niobium, a metallic element of which a few compounds alone are known, the metal itself not having been obtained. The minerals in which it occurs are rare and few in number, the chief being *polycrase*, *euxenite*, and *columbite*. Its atomic weight is 94, and its symbol Nb.

Niort, capital of the department of Deux-Sèvres, in the west of France. It is a well-built town situated on two hills. Its manufactures include leather and gloves, and it has an extensive trade in claret.

Nisch, the chief town in southern Servia, stands in the midst of a vine-growing district. It is the seat of a Greek bishop. The town has played an important part in the wars from 1375-1878, and it was here that on September 23, 1689, the Austrians gained a victory over the Turks.

Nisi prius. This phrase originally occurred in a writ commanding the sheriff of a county to bring the jurors in a civil action to Westminster by a certain day, *unless before* that day the justices came to the county to hold the assizes.

Nithsdale, WILLIAM MAXWELL, EARL OF, (1676-1744), a famous Jacobite, was born in 1676 and when 23 married. He lived on his estate at Terregles, much annoyed by the neighbouring Protestant priests. In 1715 he joined the Jacobite rising, and was captured at Preston. He was taken

to London and sentenced to death, but, not knowing that he had been reprieved, he escaped from the Tower on February 23, 1716. He died in 1744.

Nitre, known also as *saltpetre*, consists chemically of nitrate of potassium (KNO_3), and was known to the early alchemists under the names of *sal nitri* and *sal petræ*. The latter name is derived from the fact that in some countries it is obtained by the lixiviation of certain felspathic rocks. It occurs as an efflorescence on the soil in many tropical regions. It occurs thus owing to the decomposition of organic nitrogenous matter under the influence of certain bacteria [NITRIFICATION], and this action is still largely adopted for its artificial preparation. It is now very largely produced by heating potassium chloride and Chili saltpetre (sodium nitrate) in strong solutions. The nitre remains in solution, and common salt is precipitated. Nitre occurs crystallised in two forms: (1) prisms of the rhombic system, and (2) rhombohedral crystals. It is very soluble in water, the solubility increasing rapidly with the temperature, 100 parts of water dissolving about 25 parts of nitre at ordinary temperatures, and 247 parts at 100°C . It is employed extensively in medicine (known also as *sal prunellæ*), in the chemical laboratory, for pickling purposes, for the production of touch-papers and fuses, and in pyrotechny. Its chief use, however, is for the manufacture of gunpowder (q.v.), of which it forms about 75 per cent.

Nitric Acid is a compound of nitrogen, oxygen, and hydrogen, represented by the formula HNO_3 . It has been known for many centuries and was largely used by the alchemists as a solvent for different metals, and especially for dissolving away silver from a mixture of this metal with gold. Its composition was first shown by Cavendish towards the end of the last century. It is manufactured by heating together Chili saltpetre (sodium nitrate) and sulphuric acid in large iron retorts connected with a series of earthenware condensers into which the nitric acid distils. The reaction is represented by the equation



When pure, nitric acid is a colourless liquid which fumes strongly in the air, having, if concentrated, a specific gravity of 1.559. The ordinary commercial nitric acid, however, is always coloured yellow owing to the presence of dissolved oxides of nitrogen, and contains usually chlorine, sulphuric acid, oxides of iron, and frequently iodine as impurities. If boiled, pure nitric acid partially decomposes into water and oxides of nitrogen, yielding finally a dilute acid boiling at 120.5°C ., and containing about 58 per cent. of HNO_3 . Nitric acid is very largely employed both in pure chemistry and in various industrial processes. Thus, considerable quantities are employed in the manufacture of sulphuric acid, nitro-glycerine, gun-cotton, the aniline dyes, etc. Its salts are called *nitrates*, and of these many also are important from their technical uses. Silver nitrate is very largely employed in photography; potassium nitrate [NITRE] has innumerable applications, while many others are of service in the dyeing

industry and in the manufacture of fireworks. The acid and salts are also invaluable reagents in the chemical laboratory both in analysis and in organic synthesis.

Nitrification. When organic nitrogenous matter, such as animal refuse, decayed vegetation, manure, etc., is exposed to the air, a portion of the nitrogen becomes converted into nitric and nitrous acids; and then, by combination with bases such as lime or potash, into the salts *nitrates* and *nitrites*. This change is termed *nitrification*, and, by the experiments of Warrington, Winogradsky, and others, has been shown to be due to the vital activity of certain micro-organisms (*bacteria*) present in the soil. In soils where these are absent nitrification is not effected. The action proceeds best at a moderately high temperature, and in moist porous soils. It is of the utmost importance agriculturally, as plants are unable to obtain their supply of nitrogen directly from the nitrogenous organic matter present in the manure, but can obtain it from the nitrates and nitrites produced from it. Nitrification has also been employed as a source of nitre; heaps of dung, etc., being well watered with urine and exposed to the sun until the action has proceeded far enough, when the nitre is extracted with water. The vast beds of nitre and Chili saltpetre existing in many localities, as *e.g.* Chili and Peru, are believed to have been produced by this fermentative action of similar bacteria.

Nitro-Compounds. In inorganic chemistry the term *nitro* has not a perfectly definite significance; in organic chemistry, however, the term *nitro* is applied to such compounds as contain the group NO_2 combined with other radicals, the nitrogen of the nitro group being directly united to a carbon atom. Many of these compounds are very important bodies, especially in the case of the aromatic series, where they can usually be prepared by the direct action of nitric acid. Of these *nitro-benzene* $\text{C}_6\text{H}_5\text{NO}_2$, known also as *oil of mirbane* and *artificial almond oil*, is important as being the source of aniline and hence of many other important products. Similar compounds of naphthalene also are useful in synthesis of different dyes. A compound of carbolic acid with three such nitro groups is known as *picric acid*, a *carbazotic acid* (q.v.) $\text{C}_6\text{H}_2(\text{NO}_2)_3\text{OH}$, and is employed for manufacture of explosives and for staining microscopic slides.

Nitrogen ($\text{N} = 14$) is a gaseous element which composes about $\frac{4}{5}$ ths of the volume of the terrestrial atmosphere. It was discovered by Rutherford in 1772, and later Scheele and Lavoisier demonstrated its existence in the air. It is found in many minerals, usually as salts of nitric acid, or as ammoniacal compounds, and is an essential constituent of the organic compounds known as *proteids* and *albuminoids* and the *alkaloids*. It also enters into the composition of all living matter, both animal and vegetable. If phosphorus be burnt in a closed vessel of atmospheric air inverted over water, it combines with the oxygen to form an oxide which dissolves in the water. The water rises to about one-fifth the volume of the jar.

i.e. the volume of this oxygen, and the remaining space contains only *nitrogen*. It may also be prepared by other methods, and is thus obtained as a colourless odourless gas, which is characterised by its remarkable inertness, combining directly with but very few substances. It does not support life or combustion, so that animals die and lighted tapers are extinguished if placed in the gas. It can be burnt, but is only very slightly soluble in water. At very low temperatures and under high pressures it may be liquefied to a colourless liquid, and, by further cold, solidified. In the atmosphere the nitrogen plays an important part by acting as a diluent of the oxygen and weakening its otherwise too powerful and energetic oxidising properties. The loose affinity of nitrogen makes it most valuable as the basis for explosive materials.

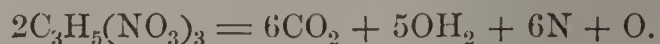
Nitrogenous Bodies. [FOOD.]

Nitroglycerine was discovered in 1847 by Sobrero, who produced an explosive liquid by stirring up glycerine with a mixture of sulphuric and nitric acids. The discovery was not, however, practically applied until Mr. A. Nobel made use of it and manufactured nitroglycerine. Various improvements in the detail of the manufacturing processes have been since introduced, and the method by which almost all this substance is now produced is that used by the Explosives Company at Arden. Here the glycerine is injected into the mixed acids, which are contained in lead tanks, kept cool. The glycerine is immediately converted into the nitro compound, and as by the change much heat is liberated the operation has to be carefully watched and the temperature kept well under control. At the close of the operation the whole charge—about three or four tons—is run into another tank, where the nitroglycerine collects and rises to the surface of the mixed acids. It is then drawn off and washed free from acid: by (1) cold water; (2) a weak alkali. The reaction may be represented by the equation



The sulphuric acid experiences no change, but acts as an absorbent of the water produced. Usually about two parts are obtained from one of glycerine, the theoretical quantity being 2.47. Experimental trials have, however, given yields as high as 2.35. The glycerine and the acids employed are always of the utmost purity, and all the operations are conducted with the strictest care and with absolutely no deviation from uniformity. So obtained, nitroglycerine is an oily liquid of specific gravity 1.60. If pure it is colourless, but it is usually brown. It is soluble in ether, benzene, etc., but almost completely insoluble in water. If cooled it solidifies, and it may be obtained crystalline. Its chemical constitution is not that of a true nitro compound (*q.v.*), but is really that of a glycerine salt of nitric acid. It possesses no odour, but has a sweet, sharp, and aromatic taste. A drop taken internally produces violent headache and pains in the back, while larger doses may cause unconsciousness. Although similar symptoms at first follow manipulation with the compound, yet habitual workers feel no ill effects from its use. It is employed to some extent

medicinally, especially in diseases of the heart; *e.g.* in *angina pectoris*. If ignited by a small flame nitroglycerine burns without explosion. It detonates violently, however, if struck or if touched by a red-hot body, and may be readily exploded by the detonation of a small fulminate cartridge. The decomposition may be represented thus:



The gases thus formed would occupy, at the temperatures produced by the explosion, a volume about 6,000 times as great as that of the nitroglycerine itself, so that the pressure produced is exceedingly great, and explains the great power of the compound as an explosive. In equal bulks, it is usually regarded as about nine times as powerful as gunpowder.

Owing to many serious explosions which followed its introduction, it fell into disrepute as an explosive; and, owing to legislative restrictions, it is never used alone as such in this country, but is immediately transformed into some other preparation. Of these there are two classes: those in which the nitroglycerine is absorbed by (1) an explosive, (2) a non-explosive absorbent. Of these preparations *dynamite* is the best known. Kieselguhr dynamite is prepared by mixing up the explosive liquid with well-calcined kieselguhr (*q.v.*), which absorbs about three parts of the compound to form a buff-coloured plastic mass. It freezes at about 40° F., and has to be thawed before use, hot water being best adapted for this. Although not as sensitive to detonation as nitroglycerine itself, yet its use requires the strictest care, neglect of which has led to many serious and fatal accidents. Other varieties of dynamite are also used containing less nitroglycerine than the above No. 1 compound, while frequently other ingredients are mixed with the infusorial earth. Other absorbents are also often employed, as *magnesia alba*, *mica powder*, etc., and the products known under a variety of names. Of the class of preparations with explosive absorbents *blasting gelatine* (*q.v.*) is that most commonly used, while other products under names of *forcite*, *lithofracteur*, *ammonia dynamite*, *lignine dynamite*, *Hercules powder*, etc., are also employed. [GUNPOWDER, GUN-COTTON, EXPLOSIVES, BLASTING GELATINE, etc.]

Nitrometer, an instrument used for the rapid volumetric estimations of a number of commercial and chemical products. It derives its name from its original use for the estimation of nitric oxide, which can be speedily effected by its means.

Nitzsch, the name of several prominent theologians, the most celebrated of whom was NITZSCH, KARL IMMANUEL (1787–1868), who was born at Borna, in Saxony, and studied and, later on, preached at Wittenburg. In 1822 he was called to a chair at Bonn, which he held till 1847, when he went to Berlin as university preacher. He was a prominent supporter of the union. He subordinated doctrine to ethics. His works were principally theological. He died in Berlin.

Noailles, DE, the name of an old noble French family, the principal of whom was ADRIAN

MAURICE, Duke of Noailles. He served with distinction in Spain, and in 1698 married. He held several high posts, being President of the Council of Finance and a member of the Council of Regency. He was exiled through Cardinal Dubois, but was reinstated in 1723. In 1734 he served in the Rhine campaign, and received a marshal's staff. He then commanded an army in Italy, and held a command on the Rhine. Old age, however, compelled him to retire, and he became a minister. He was a splendid officer, and his soldierly qualities were inherited by his sons, as in 1775 two of them were made marshals. His *Memoirs* were published by the Abbé Millot.

Noble, name of an old English gold coin current for 6s. 8d. It was first minted by Edward III., and afterwards by Henry IV., V., and VI., and by Edward IV., who made one variety (called the *rose noble*) which was worth 10s. In the old noble the obverse side bore a picture of the king in a ship, whilst the reverse had the inscription, "Jesus autem transiens per medium illorum ibat," taken from St. Luke. There were many varieties of the noble, and it was copied to a large extent in the Low Countries.

Noctuæ, one of the principal divisions of moths, including over 300 British species. They fly at night, and therefore are generally of a dull-brown colour. The chrysalides are also brown; they are common in the somites in the soil around the roots of trees.

Noddy, any bird of the genus *Anous*, of the Gull family, with six species from tropical and temperate zones. They are generally placed in a sub-family with the Terns, but the tail is not forked, and the fore part of the under mandible is bent at an angle. They feed on molluscs and small fish, and the general plumage is dusky. The Common Noddy (*A. stolidus*), about 15 inches in length, is abundant in the Atlantic and the Pacific. These birds owe their uncomplimentary popular and scientific names to their apparent stupidity, as manifested by their fearlessness of man on his visits to their island breeding-places to gather their eggs, which are excellent eating.

Node, in *botany*, the part of the stem from which the leaf is given off. It often, especially in herbaceous plants, has a distinct internal structure. Thus in *Chara*, whilst the "internodes," or parts of the stem between the nodes, are each made up of one long cell, the nodes are short and multicellular. In most grasses, including even the arborescent bamboos, whilst the internodes are hollow, the crossing of the fibro-vascular bundles renders the nodes solid. In pinks and some other plants the stem is swollen externally at the nodes. The horse-tails (*Equisetum*) and some other herbaceous plants are articulated, or separate readily into segments at the nodes.

In *physics*. Consider a vibrating cord, and imagine that two wave motions are simultaneously travelling along the cord in opposite directions. At a certain point a crest of the wave moving in one direction will meet a trough of the wave moving in the

reverse way. At that point, therefore, the cord will remain at rest, and such a point is called a node.

In *acoustics* they can be easily exhibited by the monochord. If the wire be touched at a distance of, say, one-sixth of its length from one end, and a bow be drawn across the longer part, nodes will be seen to occur at distances of $\frac{1}{6}$, $\frac{2}{6}$, $\frac{3}{6}$. . . from the end. Small strips of paper can be hung on the wire at these points without being shaken off, showing that the wire is not moving there. When a sound-wave is reflected by an obstacle in its path, as, for instance, from the closed end of an organ-pipe, a node will occur at any distance which is a multiple of half a wave-length from this closed end.

In *astronomy* they are the points in which the orbit of a planet intersects the plane of the earth's orbit—i.e. the plane of the ecliptic. When the planet passes from the south to the north side of the ecliptic it is said to be passing through its ascending node, and the other is known as the descending node.

Nodier, CHARLES EMMANUEL (1780–1844), an eminent French writer and bibliographer, born at Besançon; when ten years old he went to Strasburg, where he pursued his studies. In 1797 he became assistant-librarian at Besançon. At first he had a democratic tendency, but joined Royalist clubs and wrote against Bonaparte. Then in 1814, after several years' wandering, he went to Paris and contributed to various papers, and in 1820 made, in the *Nain Jaune*, his celebrated attack on Napoleon. Louis XVIII. made him a noble, and gave him the cross of the Legion of Honour. In 1834 he became a member of the Academy, and died in 1844. He compiled several dictionaries, and wrote numerous memoirs.

Nogay, a historical people of Turki (Tatar) stock, who are scattered over south Russia, the Crimea, and Caucasia. Chief divisions: Kara-Nogai ("Black Nogai"), Kalas-Jembuluk, and Kalas-Sabla, with total population over 100,000, of whom about half are now settled in the government of Stavropol. All are still Mohammedans, but have mostly abandoned the nomad life. The so-called "Krim Tatars" of Russian history were all Nogays, and some still survive in the Crimea.

Nollekens, JOSEPH (1737–1823), an English sculptor, was the son of a painter, and early in life was placed under Scheemakers, and in 1759 and 1760 gained premiums from the Society of Arts. He then went to Rome, where he executed busts of various distinguished Englishmen, and returned in 1770. His principal work is his *Venus nuda*, the *Sandal*. During his ten years' stay in Rome he did a great deal of work in restoring old marbles to be sold as entire genuine antiques.

Nonius, MARCELLUS, a Latin grammarian, was the author of a treatise entitled *De Compensiosa per Litteras ad Filium*, which work is divided into eighteen chapters. The first twelve are devoted to different grammatical subjects, whilst the last six are in the style of Julius Pollux, each containing a series of technical terms. Nonius probably lived

between the second and sixth centuries of the Christian era.

Non-Intervention, the policy of non-interference on the part of one nation in the affairs of other nations.

Non-Jurors, a name applied to Archbishop Sancroft and other prelates and clergy who, after the Revolution, refused to take the oath of allegiance to William III. and who were therefore deprived of their benefices.

Non-Palliata, a sub-order of mollusca belonging to the class Gastropoda (q.v.) and the sub-class Anisopleura. It includes those forms which have a slug-like body, and have lost both the mantle and shell of the ordinary mollusca. It includes the commonest of the group of "Sea-Slugs" and "Sea-Lemurs," such as *Doris*, *Elysia*, etc. The members of the group are all marine, and are usually found crawling over pools and rocks in comparatively shallow water.

Non-Suit. [PLAINTIFF.]

Nord, the most northerly department of France, situated between lat. 50° and $51^{\circ} 6'$ N., and long. $2^{\circ} 5'$ and $4^{\circ} 15'$ E.: area, 2,193 square miles. The length from N.W. to S.E. is 112 miles; the breadth, which nowhere exceeds 40 miles, becomes four only at the point where the department is traversed by the Lys. The English Channel forms the north boundary, and Belgium lies on the N.E. and E. The department is watered by the Scheldt, Sambre, and Oise. The first of these rivers divides it into two parts, that on the east being hilly and woody, whilst the west portion is a fertile and perfectly level plain. Lille (q.v.) is the largest town. The department is rich in minerals, especially coal, and the cotton, linen, woollen, lace, and other manufactures are very important.

Nordenskiöld, NILO ADOLF ERIC, BARON, (b. 1832), Arctic explorer, was born at Helsingfors, in Finland, and studied in the university of that town, and afterwards at Berlin, devoting himself especially to mineralogy and other sciences. Having incurred the suspicion of the Russian Government, he was compelled to remove to Sweden, and in 1858 became director of the mineralogical department of the Royal Museum at Stockholm. Between 1861 and 1873 he led four expeditions to Spitzbergen. His success in navigating the Kara Sea as far as the Yenisei (1875) convinced him of the practicability of a sea route through the Arctic Ocean to Behring Strait; in 1878 he accomplished this voyage in the *Vega*, reaching Yokohama in September, 1879. He has twice visited Greenland.

Nordhausen, a town of Prussian Saxony, on the Zorge, at the south base of the Harz Mountains, 48 miles N.N.W. of Erfurt by railway. The buildings include a late Gothic cathedral, with a Romanesque crypt; a church dedicated to St. Blasius, containing two pictures by Lucas Cranach; and a mediæval town-hall. There are important breweries and distilleries, and leather, tobacco, and chemicals are manufactured.

Nore, a sandbank in the estuary of the Thames,

three miles N.E. of Sheerness. The name is also applied generally to the anchorage (7 to 10 fathoms), in the W. part of the estuary. The mutiny among the fleet at the Nore (1797) caused a temporary cessation of traffic, but was suppressed after lasting three weeks.

Norfolk. 1. A maritime county of England, bounded by the North Sea on the N. and E., Cambridgeshire and Lincolnshire on the W., and Suffolk on the S.; area 2,119 square miles. The greatest distance from N. to S. is 70 miles, and the extreme breadth 43 miles. The land adjoining the sea-coast, which is over 90 miles in length, is in almost all parts low and flat; but in the interior the surface, though it nowhere rises to any great height, is undulating and well wooded. Much destruction is caused by the encroachments of the sea, but along the shores of the Wash (q.v.) an extensive tract of good land has been reclaimed. The chief rivers are the Yare, which rises in the centre of the county and flows E., with its tributaries the Waveney and the Bure, and the Ouse, which flows N. to the Wash near the west border. Much of the E. part of the county is composed of the shallow lakes called Broads (q.v.). The soil consists for the most part of light sand and loam. Ever since Lord Townshend (q.v.) introduced high farming on his estate at Rainham, Norfolk has taken a leading place amongst the agricultural counties; winter roots, especially, are cultivated with great success. There is good pasture-land along the banks of the rivers and on the Cambridgeshire border, and many turkeys and geese are reared for the London markets. The most noted of the numerous fisheries along the coast is the herring industry at Yarmouth. Norfolk contains the city of Norwich, the parliamentary and municipal borough of Kings Lynn, most of that of Great Yarmouth, and the greater part of the municipal borough of Thetford.

2. A city and port of entry in Virginia, United States, on Elizabeth river, an arm of Chesapeake Bay, 75 miles S.E. of Richmond. Several railways and canals converge here, and there is communication by steamers with New York, Richmond, etc. Norfolk has a large naval yard, and carries on a considerable trade in cotton, fruit, vegetables, oysters, maize, and sugar.

Norfolk Island, a dependency of New South Wales in the Western Pacific, about 450 miles N.W. of the north point of New Zealand; area $13\frac{1}{2}$ square miles. The mean altitude of the cliffs is 400 feet, whilst Mount Pitt, in the centre, rises 1,039 feet above the sea. The climate is healthy. The chief product is the Norfolk Island pine. The island was a penal settlement from 1788 to 1805 and from 1826 to 1855. The descendants of the *Bounty* mutineers were removed hither from Pitcairn Island in 1856.

Norman Architecture, a round-arched variety of mediæval architecture derived from the Romanesque. It was introduced into England before the Conquest, and lasted until the end of the 12th century, when it gradually changed to the Early Pointed. The principal feature of Norman architecture was its massive nature and rugged simplicity. The doorways are deeply-recessed

with fine mouldings and rich surface sculpture. The windows are small and placed high in the wall, and the buttresses, though thick, do not project much. There is a fine Norman Porch in



NORMAN ARCHITECTURE: THE WHITE TOWER, LONDON.

the Close of Canterbury cathedral, and the Keep of the Tower of London is also a good example of this style.

Normandy, an ancient province of France, now included in the departments of Seine Inférieure, Eure, Calvados, Manche, and Orne. It takes its name from the predatory bands of Norsemen (q.v.) who, after numerous expeditions along the coast and up the rivers of France, dating from about 840 A.D., attempted to form permanent settlements in the country. The only one of these "Normandys" that was ultimately successful was that which retained the name. By the treaty of Clair-sur-Epte (912) between Charles the Simple, king of the West Franks, and the Norse leader, Rolf or Rollo, it was agreed that the latter should retain possession of the Neustrian lands he had conquered west of the rivers Eu and Epte, but acknowledge the Frankish monarch as his overlord. The limits towards the W. were less clearly defined, and Rolf's son, William Longsword (927-43), extended the duchy in that direction till it became continuous with Brittany. The newly-conquered districts were mostly colonised by new-comers from Norway, who clung to their old religion, language, and customs, whilst in western Normandy Frankish influences predominated. This difference of tendency gave rise to constant dissensions, which

frequently culminated in active hostilities; but the Scandinavian party were conquered by Richard the Fearless (943-96), who was aided by Louis and Hugh, Duke of Paris. In 987 Hugh of Paris usurped the west Frankish throne, and the Houses of Capet and Rollo found it to their mutual advantage to maintain friendly relations, which subsisted with little interruption to the conquest of England in 1066. Richard the Good reigned from 996 to 1026, and Richard III. from 1026 to 1028. The marriage of Emma, sister of the former, to Ethelred (and afterwards to Cnut the Great) for the first time brought Normandy into close connection with England. Richard III.'s brother, Robert (1028-35), left the duchy to his natural son, William, a child of eight. His minority and doubtful claim afforded a new outlet for turbulent forces, and a period of feudal anarchy ensued, but it was brought to a close by William's victory at Val-ès-Dunes (1047). The remainder of his reign as ruler of Normandy alone (1047-66) was spent in consolidating the royal power and aiding the civilising efforts of the Church. His vigorous policy, however, produced little permanent result, for the Conquest drew away the attention of his successors to England, so that Normandy again became a prey to feudal violence. It was the hopes of the turbulent barons which led them to support William's eldest son, Robert, rather than William Rufus or Henry I., the latter of whom finally defeated Robert at Tenchebrai (1106). With the exception of a short period in Stephen's reign, during

which it was held by Geoffrey of Anjou, Normandy remained united to England till it was wrested from John by Philip Augustus (1203-4). From that date its history becomes merged in that of France.

Noronha, FERNANDO, a group of islands in the Atlantic Ocean, 210 miles E.N.E. of Cape San Roque. The main island is about seven miles in length and two in breadth. They consist of a mass of volcanic rocks, with a soil of rich ferruginous clay, which affords an abundant growth of maize, cotton, sugar, melons, wild grasses, and various kinds of trees. The islands belong to Brazil; there is a penal settlement on the largest.

Norris, SIR JOHN, British naval officer, was born about 1665, and, having entered the navy, was made a commander in 1690. In the same year he became a captain. As rear-admiral, a rank which he reached in 1707, he forced the passage of the Var and took part in the siege of Toulon; in 1708 he was made a vice-admiral, and in 1709 an admiral. He died 1749.

Norrköping, a Swedish town, situated at the head of the Bråvik, an arm of the Baltic, where it is joined by the river Motala, 113 miles S.W. of Stockholm by railway. There are oil-mills, sugar-refineries, ship-yards, and linen, cotton, and woollen manufactures.

Norse (originally *Norskr*, *Norsk*, from root

Nordhr, "north"), collective name of the northern branch of the Teutonic race (q.v.). In this sense the term is practically synonymous with *Scandinavian*, comprising the Danes, Swedes, Norwegians, and Icelanders, that is, the four main divisions of the Norse or Scandinavian group, which presents certain distinctive physical and linguistic features now best preserved in Iceland (q.v.). These distinctive features do not appear to be of great age, and 2,000 years ago the Norse peoples probably differed little, either in appearance or in speech, from the other branches of the Teutonic family; but then began a gradual divergence, resulting in the present differentiation of physical and linguistic forms. Physically the Norse peoples have remained truer to the primitive Germanic type, characterised by tall, bony figures, robust frames, long head, regular oval features, blue or grey eyes, long, wavy flaxen, and even red, hair, disproportionately large extremities. At least, this blonde or "Saxon" type is still far more prevalent in Scandinavia than in Germany, where great interminglings have taken place with the dark pre-Aryan aborigines. Hence the Norse peoples, though far from the ideal blondes, now best represent Huxley's *Xanthochroi*, or "fair white," as distinct from the *Melanochroi*, or "dark whites" of southern Europe; and recent research has traced back for at least 4,000 years the presence of this blonde race in the Scandinavian peninsula, where in fact many ethnologists suppose that it originated in the Neolithic age. In early mediæval times (9th to 12th century) the Norsemen (chiefly Danes and Norwegians) overran a great part of Russia and the European seaboard, extending their predatory and conquering excursions from Greenland, Iceland, and the British Isles, up the Mediterranean to the Levant. They even founded flourishing kingdoms in the Seine basin (Normandy) and in Sicily, but were everywhere rapidly absorbed in the surrounding populations, except in the Farøe Islands, and especially in Iceland, where they came rather as settlers than as corsairs or conquerors, and where the Norse race and speech are still best preserved. [ICELAND.]

The Norse language is a modified form of early Low German, that is, of the primitive Germanic tongue as best represented by the Gothic of Ulphilas [GOTHIC], from which it differs partly in its phonetics (normal change of final *s* to *r*, as in Goth. *sunus*, Icel. *sunr*, "son"), but much more in its grammatical forms. Of these the most characteristic are the evolution of a passive or rather a middle voice, and of a definite article agglutinated at the end of the noun, as in Roumanian (*homu-l*, "man-the"), and some others south-east European languages. These, however, are comparatively recent changes, although traces of them occur in the Icelandic Edda, which suffixes the article, and even in the *Norraena Tunga*, that is, the original "Norse Tongue" as preserved in the early Runic inscriptions. They receive their full development only in Swedish and Danish, the chief modern representatives of the old language, which are thus distinguished in a marked way from all other members of the Teutonic linguistic family.

North, an illustrious English family, founded by SIR EDWARD NORTH (1496–1564), an eminent lawyer, who was created Baron North of Kirtling by Queen Mary. His second son, SIR THOMAS NORTH (1579), is remembered as the translator of Plutarch. DUDLEY NORTH, 4th baron, wrote a life of his ancestor, the first lord. Four of his sons were eminent men in their day, and their memory has been preserved in the garrulous and laudatory, but fascinating *Lives* written by Roger, the youngest of the number. The eldest, FRANCIS (1637–85), was successively Solicitor-General, Attorney-General, and Chief Justice of the Common Pleas, and in 1672 became Lord-Keeper with the title of Baron Guildford. SIR DUDLEY NORTH (1641–91) engaged in commerce and made a fortune in the Levant, passing many years at Smyrna and Constantinople. After his return to England he was appointed a Commissioner of Customs. He had a wide knowledge of architecture, and possessed great mechanical skill. JOHN (1645–83) succeeded Barrow as Master of Trinity College, Cambridge, in 1677. ROGER (1653–1733) practised as a lawyer in London, but after the Revolution withdrew to his seat of Rougham in Norfolk. Besides the *Lives* of his brothers and his unfinished *Autobiography*, he wrote an *Examen* of Kennet's *History*, abounding in minute details, on which Macaulay drew largely. FREDERICK NORTH, 8th Baron North and 2nd Earl of Guildford (1723–92), entered Parliament in 1754. In 1767 he was appointed Chancellor of the Exchequer and became leader of the House of Commons. As Prime Minister from 1770 to 1782 he must be held responsible for the loss of the American colonies, though he often acted in opposition to his better judgment, owing to his anxiety to please the king. After the Rockingham and Shelburne Ministries had run their course, he returned to power as one of the Secretaries of State under Lord Portland, the other being Charles James Fox; but the union of these old enemies excited universal distrust, and the Coalition Ministry was dismissed in December, 1783. Lord North succeeded his father as Earl of Guildford in 1790.

Northampton, a municipal and parliamentary borough, and the capital of Northamptonshire, is situated on Watling Street, and stretches upwards from the left bank of the Nen; it is 67 miles N.W. of London by railway. The public buildings include a town hall (1864), ornamented on the outside with statues of English kings, a county hall, and a corn exchange (1850). There are two interesting old churches, St. Peter's (Norman) and St. Sepulchre's, which was built for the Templars by Simon de St. Liz in 1127 and is one of the four round churches in England modelled on the plan of the Church of the Holy Sepulchre at Jerusalem. All Saints' church was destroyed by a great fire in 1675 and rebuilt by Wren five years later; the ancient tower remains. A little S. of the town is one of the beautiful crosses erected by Edward I. in memory of his queen, Eleanor, in a very good state of preservation. Northampton is the centre of the boot and shoe manufacture; the other industries include leather-dressing, paper-making, and brewing.

Outside the town is the racecourse, where the Pytchley Hunt races are held in April and November.

Northamptonshire, a south-midland county of England, bounded by Rutland and Lincolnshire on the N., Cambridgeshire, Huntingdonshire, and Bedfordshire on the E., Bucks on the S.E., Oxfordshire on the S., Warwickshire on the W., and Leicestershire on the N.W.; area 984 square miles. It is 67 miles from N.E. to S.W. with an extreme breadth of 26 miles. Excepting in the N.E., which forms part of the Fen district, the surface is mostly hilly, but the highest point, near Daventry, is only 804 feet above the sea. The chief rivers are the Welland and Nen, flowing N.W., and there is also communication by water along the Grand Junction and other canals. The soil is generally fertile, consisting of a brown loam in the hilly district and a rich black mould in the N.E. portion, and corn-growing, cattle-rearing, and dairy-farming are alike thriving industries. The manufacture of iron has made great progress since the middle of the century; the other industries are for the most part confined to Northampton (q.v.). The county contains the municipal and parliamentary borough of Northampton and part of that of Peterborough, with the municipal borough of Daventry, and part of that of Stamford.

North Carolina, one of the original United States of America, situated between lat. $33^{\circ} 50'$ and $36^{\circ} 33' N.$, and long. $75^{\circ} 27'$ and $84^{\circ} 30' W.$, and bounded on the N. by Virginia, E. and S.E. by the Atlantic, W. by Tennessee, and S. by South Carolina and Georgia; area, 52,250 square miles. It was discovered by Raleigh (1585-87). The state may be divided into three sections, of which the most westerly is mountainous and that on the E. level, with tracts of swamp, the area between them being occupied by an undulating and extremely fertile region. The Iron and Alleghany Mountains run parallel near the Tennessee border, and between them is Mitchell's Black Dome (6,700 feet). Along the coast runs a long line of sandbanks, forming the outer barrier of the shallow lagoons. There are five large navigable rivers, of which the Roanoke and the Cape Fear are the chief. Excepting certain districts near the coast, North Carolina has a productive soil and a healthy climate. The chief crops are cotton, maize, tobacco, sweet potatoes, and fruits which are dried for export. The pine-woods in the E. section afford an abundant supply of timber, and here there are numerous saw-mills as well as works for the production of resin, tar, pitch, and turpentine oil. The state is rich in gold, silver, iron, copper, and other minerals. The manufacture of cotton and woollen goods and of tobacco has recently made some progress. Raleigh, an inland city, is the capital, but Wilmington is the chief port and most important town.

North-East Passage, THE. The discovery by Stephen Brough in 1556 of a strait between Novaya Zemlya and the mainland gave rise to projects for finding a north-east passage from Europe to China. Attempts in that direction were made in 1568 and in 1580 by the Company of

Merchant Adventurers, and in 1594 by Barentz and Linschoten. Barentz made a second effort in 1595, and a third in 1596. In the course of this, after discovering the north-east coast of Spitzbergen, he perished. His discoveries, which were pushed farther and farther by successive whaling expeditions, were perfected by Wrangell in 1822 and by Long in 1867; but the route, owing to the ice, is impracticable for commercial purposes.

North Sea, an extension of the sub-polar or Norwegian Sea, to which it lies open on its north side. The lands surrounding it are Norway, Denmark, and Schleswig-Holstein on the E., Great Britain on the W.; and Prussia, Holland, Belgium, and France on the S. It communicates with the North Atlantic by the Strait of Dover, the Pentland Firth, and the passage between the Orkneys and Shetlands, and with the Baltic by the Skager Rack and Cattegat. Its limits are lat. 51° and $61^{\circ} N.$, and long. $2^{\circ} 30'$ and $8^{\circ} E.$ Its greatest length is about 600 miles, its greatest breadth (from the Firth of Forth to Jutland) about 400 miles, and its area about 150,000 square miles. The sea is shallow, especially towards the south and east, where the shore is low and flat. In general, the height of the cliffs varies directly with the depth of the neighbouring water. Excepting in the trench or belt, 50 miles in width, called the "Norwegian Gully," which encircles the south coast of Norway, the depth nowhere exceeds 100 fathoms; in the gully soundings of 400 fathoms are not unknown. In the south central part of the sea there are numerous "pits" or "banks," the most important being the Dogger Bank, midway between North England and Schleswig, above which the average depth is only 12 or 15 fathoms. The formation of these banks is ascribed to the detrital matter remaining from the glacier which filled the sea during the glacial period. Near the coast, shoals and sandbanks are formed from the terrigenous deposits brought down by the great rivers. The tides of the North Sea as far south as the Thames are regulated by the north branch of the great Atlantic tidal wave, which sweeps round the north coast of Scotland, and causes high water on the shores of Scotland and Norway at almost exactly the same time. From time immemorial this sea has been an important commercial highway. It abounds in food-fishes, crustaceans, and molluscs, and the fisheries are both extensive and valuable.

Northumberland, the most northerly county of England, separated from Berwickshire on the N. by the Tweed, from Roxburghshire on the N.W. by the Cheviot Hills, and bounded W. by Cumberland, E. by the North Sea, and S. by Durham; area 2,016 square miles. The surface is for the most part rugged, rising gradually to the height of 2,676 feet, in the Cheviot Hills and becoming wild and bleak in the moorland district of the south and south-west. Along fertile valleys which traverse the county eastwards from the spurs of the Cheviots flow the Till, Alne, Coquet, Wansbeck, and other streams; the other rivers include the Tweed and the Tyne, which in the last part of its course forms the boundary with Durham. The geological formation consists of Silurian rocks in the north-west,

with Triassic and Permian beds, and a vast tract of coal-measures near the coast; the Cheviots are mostly composed of porphyrites and andesites. Coal-mining is carried on in the south-east, lead-mining (a declining industry) in the south-west. The valleys and the district near the coast have a clayey loam soil, yielding rich crops of barley, wheat, and beans. Cattle and sheep are reared extensively in the west part of the county. The Northumberland rivers and their estuaries abound in salmon and other fish. A large group of connected industries, such as iron-working, ship-building, etc., has been established along the banks of the Tyne.

Northumbria, the most northerly of the old English kingdoms, formed by the union of Bernicia and Deira through the conquest of the latter by Æthelric, king of Bernicia about 590 A.D. The kingdom of Bernicia, which extended from the Tees to the Firth of Forth and was bounded west by Strathclyde, had been founded by Ida about 547, whilst Deira, situated between the Tees and the Humber with Cumbria on its west side, owed its origin to Ælla (*c.* 560). The power of Northumbria increased under Edwin, Oswald, and Oswy, who held the office of *bretwalda* (q.v.), but declined with the advance of Mercia in the 8th century. It submitted to Wessex in 827, and became subject to the Northmen in 866.

North-West Passage, THE. The project of finding a passage by sea round the northern extremity of the American continent seems to have seriously originated with Sir Humphrey Gilbert, though such a passage is marked on some earlier maps of a speculative character and though a Mexican friar, named Urdarieta, claimed to have actually made it. It was successively attempted by Frobisher, Davis, Hudson, Baffin, and many more; but its discovery was reserved for Sir John Franklin, who did not live to announce the fact, and for Captain R. J. Maclure, who, in October, 1850, passed through Prince of Wales's Strait into Barrow Strait, which communicates, through Melville Sound, with the Arctic Ocean. Maclure had to abandon his ship, the *Investigator*, in the ice, but returned safely to England in 1854.

North-Western Provinces, a lieutenant-governorship of British India, situated between lat. $20^{\circ} 51'$ and $31^{\circ} 5' N.$, and long. $77^{\circ} 3'$ and $84^{\circ} 43' E.$, and bounded by Tibet on the N. and Nepal on the N.E.; area 106,111 square miles. It comprises a large part of the vast plain extending from the Punjab to Lower Bengal, and is watered by the Ganges, the Gogra, and the Jumna. The soil is fertile, and produces immense crops of wheat. The district was formed in 1835, and since 1877 has included Oudh for all purposes excepting the management of its land and courts. Alláhábád is the administrative capital.

Norton, ANDREWS (1786–1853), American theologian, was born in Massachusetts, and educated at Harvard, where he occupied the chair of sacred literature from 1819 to 1830. He published *Reasons for not Believing the Doctrines of Trinitarians* (1833) and other works written from

the Unitarian standpoint. His son, CHARLES ELIOT NORTON (b. 1827), is a well-known man of letters, who has travelled much in Europe. He conducted the *North American Review* in conjunction with Lowell (1864–68), and has edited Carlyle's letters, and those of Lowell (1893).

Norton, HON. MRS. CAROLINE ELIZABETH (1808–77), poetess and novelist, was the granddaughter of Sheridan. Her marriage with the Hon. George Norton was an unhappy one, and the husband and wife separated after living together for three years. Three months before her death she married Sir William Stirling-Maxwell. Besides numerous poems, including *The Sorrows of Rosalie* (1829) and *The Lady of La Garaye* (1862), she wrote *Stuart of Dunleath* (1847) and two other clever novels.

Norway, a kingdom of Europe, occupying the W. and extreme N. parts of the Scandinavian peninsula. It lies N.E. and S.W., between lat. $57^{\circ} 59'$ and $71^{\circ} 11' N.$, and long. $4^{\circ} 30'$ and $31^{\circ} 12' E.$, and is bounded by the Arctic Ocean on the N., the Atlantic on the W., the North Sea and Skager Rack on the S., and Sweden on the E., the most northerly province—Finmarken—extending N. of Swedish and Russian Lapland. It has an area of 122,800 square miles, and is over 1,100 miles long, with an average width of 70 miles between lat. 64° and $68^{\circ} N.$, which increases to 280 miles at lat. 61° . The length of the coast-line (excluding the fjords) is 3,000 miles.

Physical Features. The greater part of Norway is a rocky plateau composed for the most part of gneiss and mica-slate, with an elevation of 2,000 to 4,000 feet, the surface of which is broken by ridges and heights rising to 6,000 feet and upwards, and wide fissures which form valleys, lakes, and fjords. The Kjölen range (3,000 to 6,000 feet), which divides Norway from Sweden, runs nearly parallel to the coast from lat. 69° to $63^{\circ} N.$; at that point a series of great "fjelds" (broad, lofty, and generally level tracts of tableland) branch off W.S.W. (in the Dovre Fjeld), afterwards diverging S.W., and finally S. in the Langfjeld and their continuations, so that their direction is still in the main the same as that of the coast-line. On the E. border the Kjölen Mountains are continued southwards in a line of lower ranges. The "backbone" formed by the Kjölen Mountains in the N. and the great fjelds in the S. divides the country into three sections—the Nordenfjeldske, comprising the whole region north of the Dovre Fjeld; the Vestenfjeldske, extending west of the Langfjeld, and the plateaux south of them to Lindesnaes (the Naze), the south extremity of Norway; and the Söndenfjeldske or Östland, which lies south of the Dovre Fjeld and east of the Langfjeld. The whole of the west sea-border is fringed with groups of rocky islands (the Skjaergaard), which render navigation difficult, whilst the channels between them and the mainland, as well as the numerous fjords which penetrate into the interior of both, afford good anchorage. Finmark, in the extreme N.E., is for the most part an undulating, desolate, and almost treeless plateau, 1,000 to 2,000 feet above the sea.

From the North Cape to Bindals Fjord, in about lat. 65° , the shore is wild, rugged, and deeply indented with fjords, behind which tower precipitous mountains, rising in some places to a height of 3,300 feet or more. The Lofoden Islands (between lat. $67^{\circ} 30'$ and $69^{\circ} 30'$), separated from the mainland by West Fjord, which in some places is 60 miles broad, exhibit an endless variety of fantastic forms. The most interesting feature of the Kjölen Mountains on the Nordland frontier is the vast Sulitjelma snowfield, which has an elevation of 6,166 feet. The scenery of the wooded and agricultural districts in the neighbourhood of the town of Trondhjem is far less impressive. At the south extremity of Trondhjem stift is the Dovre Fjeld, a wide, dreary, undulating moorland with an average elevation of 3,600 feet, the highest point being Snehætta (7,610 feet), long believed to be the loftiest mountain in Norway. Jostedalstræ, S.W. of the Dovre Fjeld between Nord Fjord and Sogne Fjord, is either the largest or the second largest glacier in Europe. It lies 4,000 to 5,400 feet above the sea, and covers 500 or 600 square miles. Several ice-streams, amongst which the "Lodal Glacier" is the finest, flow down to a height of 165 feet, coming within 5 miles of the fjord. The Langfjeldene include several groups, the most remarkable being the Jotun Fjeld, which was first explored in 1820. It has more than 100 peaks of over 6,000 feet, many with bare and almost perpendicular sides standing out in bold relief from the surrounding snow. Glaciers and névé fields spread on every side, and the depressions are for the most part filled with broad and deep lakes. The highest points in this fjeld are Galdhøpiggen (8,397 feet), the loftiest mountain in Norway, and Glitretind (8,379 feet). The Kystland between Romdalsfjord and Stavanger is on the whole the grandest and most romantic stretch of coast in Norway. It is intersected by spurs of the Dovre Fjeld and Langfjeldene, between which lie deep, narrow, and winding fjords, sometimes extending over 100 miles inland, and sending out branching arms in all directions. At every turn, cataracts and waterfalls rush precipitously down their rocky sides, often from a height of 3,000 or 4,000 feet. They sometimes terminate in narrow valleys, such as Romsdal, which run up into the interior at a somewhat higher elevation. The inner arms of the fjords are generally clothed with a rich growth of crops and other vegetation. Between Stavanger and Lindesnaes lie the fertile but tame lowlands of the Jæderen and Listerland. The Söndenfjeldske differs wholly in character from the Norden- and Vestenfjeldske. The broad valleys which slope south and south-east towards Christiania Fjord between rounded and pine-clad hills are the beds of impetuous torrents, which often expand into large lakes, the finest being Lake Mjösen on the Laagen, about 60 miles long. The longest of these rivers is the Glommen (nearly 400 miles).

Climate. Owing to the influence of the Gulf Stream the winters in North and West Norway are comparatively mild. The sea on these coasts is seldom or never frozen, though this frequently occurs in Christiania Fjord and the Skager Rack.

The cold is most severe at the places farthest inland, such as Roraas. The south part of the west coast has an annual rainfall of 40 to 70 inches.

Population; Industries and Commerce; Communications. In Jan., 1891, Norway contained 1,998,771 inhabitants, the rural population numbering 1,526,871. This total included 7,637 Lapps and 17,178 Finns.



MAP OF NORWAY.

The largest towns are Christiania, the capital Bergen, Trondhjem Stavanger, and Drammen. As 73 per cent. of the soil is incapable of cultivation, and 24 per cent. is covered with forests, the country cannot furnish sufficient food for the inhabitants, and large quantities are imported. About 20,000 persons emigrate annually, and those who remain behind are fairly prosperous. Over 50 per cent. of the agricultural population are small peasant proprietors. Potatoes are very extensively grown, even in the most northerly latitudes; peas are also an important product, and all the ordinary cereals thrive, barley ripening as far north as 70° . The pastures are situated on the fjelds, often 30 or 40 miles from the farm to which they belong. The pine forests, which are most dense in Östlandet, are far more profitable. They are usually felled during the winter, and in the ensuing spring floated down the rivers to the saw mills at their mouths. The other great home industry of Norway is the fishing trade. The cod and herring fisheries are by far the most important, the number of persons engaged in them in 1890 being 89,283 and 29,804 respectively. Cod abound on the west coast, the season lasting

from January to April, whilst herring are taken at all times of the year. There is a fair abundance of minerals, especially silver, copper, and iron; but this branch of industry is not very important. Such manufactures as Norway possesses (including textile goods, machines, tobacco, and chemicals) are for the most part located in the neighbourhood of Christiania. Norway is actively engaged in the carrying trade, and possesses a larger mercantile marine than any other nation in Europe, excepting Great Britain. The number of ships owned by Norwegians which entered her ports in 1891 was 6,671, with a tonnage of 1,716,000. The exports from Norway amounted in 1891 to 124,082,300 kroner (about £6,376,450), showing a decrease of 349,800 kroner from 1890, the imports to 223,023,600 kroner (about £11,460,935), showing an increase of 14,364,700 kroner. The chief exports are fish; oil, and other animal produce; timber and wooden goods (among which lucifer matches form an important item); and skins, furs and feathers. The principal imports are articles of food, especially breadstuffs, machinery of various kinds, and textile manufactures. Great Britain and Germany are the countries with which Norway has the largest trade. In addition to numerous good roads, the internal communications of the country are carried on by means of 5,174 miles of railway and 5,490 miles of telegraph lines, by far the greater portion of both being State property.

Government; Army and Navy; Finance. The Norwegian constitution was formulated in 1814, and has since been frequently modified. The authority of the Sovereign, who is also King of Sweden, is extremely limited. He is assisted in his executive functions by a responsible council composed of two ministers, together with seven councillors, at the head of as many departments. The members of the legislative body, called the Storting, are elected at intervals of three years by deputies, each of whom represents either a hundred rural or fifty urban voters. On meeting it divides itself into the Lagthing, containing twenty-nine selected members, and the Odalsting, composed of the remaining eighty-five, which originates all bills. After a bill has been twice rejected by the Lagthing, its fate is decided by a two-thirds majority of the united houses. The King's power of veto expires when a bill has been passed by three successive Storthings. He has no power of dissolving the Storting. The electors include about 7 per cent. of the population, the franchise depending on certain property and other qualifications. For purposes of local administration, the six stifts or bishoprics—Christiania, Christiansand, Bergen, Hamar, Throndhjem, Tromsö—are divided into twenty districts—viz. the towns of Christiania and Bergen, and eighteen Amts (counties or provinces), each of which is under the direction of an Amtmand. The Amts are subdivided into Fogderier, and these again into Herreds (rural communes). The army is composed of troops of the line (35,000), mainly raised by conscription, from which the three northern Amts are exempt, the Landværn (militia) and the Landstorm (a reserve force consisting of all able-bodied males.) The

navy (which has forty-six steamers) is largely recruited by conscription from Nordland, Tromsö, and Finmarken. The public revenue amounted in 1891 to about £2,643,750, the expenditure to about £2,517,747, and the debt to about £5,964,360.

Character of the People; Religion and Education. The Norwegians are a sturdy, thrifty, independent, and, on the whole, a moral people. The democratic feeling is strongest in the country districts. They are mostly devout members of the Lutheran Church, which is the only established form of religion. Jews are tolerated. Education is free, and compulsory between the ages of seven and fourteen. In addition to the parish schools, there are schools of a higher grade in most towns, also seventeen lyceums, and the national university at Christiania is attended by about 1,650 students.

History. Up to the end of the 9th century the Norse branch of the Teutonic family was known to the outside world only through the expeditions of the Vikings, who about 787 A.D. began to devastate the shores of Western Europe. The attempt of Halfdan the Black and his son, Harald Hårfagr (circa 850–930), to extend their sway from their native district of Vestfold over the whole of Norway, drove fresh swarms of invaders to seek new homes in other lands. The supremacy of Harald was acknowledged by the petty rulers—kings, jarls, or hersirs—as far north as Throndhjem, which he made the centre of his kingdom. Under Harald and his successors the people retained a large measure of the liberty which they had previously enjoyed, and at the “things,” or public meetings, the kings were often reminded, forcibly enough, that there were limits beyond which they could not venture to go. The great things, eventually four in number, were formed by uniting the assemblies of several fylkis (the old local divisions) so as to constitute larger aggregates. Of these early kings, whose story is graphically told in the pages of Snorri Sturluson, the Icelandic historian, the most famous were Olaf Tryggvason (q.v.), Olaf the Saint (q.v.), and Harald Hardrada, one of the most romantic figures in mediæval history. On the death of Hakon I., in 1319, the crown passed to his daughter's son, Magnus of Sweden, and by the Calmar Act of Union, in 1380, the three northern realms were united under Margaret of Denmark. There is now a break of over 400 years in the history of Norway as an independent state. In 1814 she transferred her allegiance at the bidding of the Congress of Vienna (with great reluctance, and after preparation for armed resistance) from Denmark to Charles XIII. of Sweden, receiving at the same time a constitution of her own. The feeling in favour of separation from Sweden is becoming more marked every year, and the king may find himself compelled either to surrender the existing unity of foreign policy (in which case the establishment of a Republic would only be a question of time), or enforce the Swedish reading of the Act of Union by resorting to coercive measures—that is, by beginning on a war between the sister kingdoms. It is said that the crisis may possibly terminate in a reunion with Denmark on

the terms that connected Norway with Sweden in 1814, but the announcement is, to say the least, premature.

Literature. The recovery of independence in 1814 was speedily followed by the growth of a national literature. Wergeland (1808-45) and Welhaven (1807-73) were the chief writers of fiction during the earlier period. Among more recent novelists the best known are Jonas Lie (b. 1833), Kjelland (b. 1829), and Bjørnstjerne Bjørnson (b. 1832). The dramas of Henrik Ibsen (q.v.) depict the evils of the existing state of society with a tragic force which has spread their author's fame throughout Europe. Bjørnson also, who formerly delighted the world by his idyllic tales of country life, has now become the preacher of a new social gospel. The names of the mathematician Abel (1802-29), the zoologist Sars (1805-69), the orientalist Lassen (1800-76), the historian Munch (1810-63), and the theologian and philosopher Bugge (b. 1838), are all distinguished in their several spheres. Norway has produced several eminent musicians, including the violinist Ole Bull (1810-80) and the composer Edvard Grieg (b. 1843).

Norway Spruce. [SPRUCE.]

Norwich, the county town of Norfolk, a city, parliamentary and municipal borough, and county



Valentine and Sons, Dundee, Phot.

NORWICH CATHEDRAL.

in itself, is situated on the Wensum, 20 miles W. of Yarmouth and 114 N.E. of London. The city is ancient and picturesque, with no main thoroughfare, the narrow and rambling streets converging

towards the market-place. It is believed to have been the British *Caer Gwent* and the Roman *Venta Icenorum*. The chief glory of Norwich is its cathedral, which was founded in 1096 by Bishop Herbert Losinga, and retains most of its original Norman features. The W. front, nave, and aisles were altered in the Perpendicular period, and to the latter style belong also the magnificent vault with bosses representing scenes in Scripture history, the clerestory and vault of the presbytery, and the choir-stalls. The cathedral is 407 feet long and 72 feet broad, the length of the transept being 178 feet. The united height of the Norman tower and Decorated spire is 315 feet. The cloisters, Perpendicular in style, are exceptionally beautiful. Of the castle, the only remaining part is the massive Norman keep, 70 feet high, and about 90 feet square. Of the 43 churches in Norwich the most noteworthy are those of St. Peter Mancroft and St. Andrew. St. Andrew's Hall, in which are held the triennial musical festivals, was originally the nave of the Black Friars' church, rebuilt about 1450. There are many other relics of the Middle Ages, including the Guildhall (1408-13), the old Bridewell (*circa* 1370), the grammar-school (*circa* 1316), and two gateways, St. Ethelbert's (1275) and the Erpingham Gate (1420) leading to the cathedral precincts. Norwich was at one time the chief seat of the worsted manufacture, which was introduced from Flanders in the 14th century, and crapes, camlets, and other textile fabrics are still manufactured; but the principal industries are now boot- and shoe-making, iron-working, and the manufacture of starch and mustard. There are factories for oil-cake and agricultural implements, and market-gardens abound in the neighbourhood.

Nose. The outer part of the nose consists of a framework of bone and cartilage with certain muscles lying beneath the integument. The two orifices are termed the *anterior nares*. On tracing backwards the spaces into which these orifices lead, they are found to pass into what are known as the *nasal fossæ*. These two fossæ are separated one from another by a median partition, the *septum* of the nose, while their outer walls are formed by three bones which are called the turbinate, spongy bones. These bones project from without inwards, arching over, and, though they do not extend to the middle line, they practically divide each nasal fossa into three parts, which are known as the *superior*, *middle*, and *inferior meatuses*. Posteriorly, each nasal fossa communicates with the pharynx by an aperture, these apertures being known as the *posterior nares*. The bony framework of the nasal fossæ is lined by a mucous membrane, the *pituitary* or *Schneiderian membrane*. The epithelial lining of this membrane presents different characters in different parts. In the lower part the epithelial cells are ciliated, and, as it is through this part that the currents of air mainly pass in ordinary breathing, it is termed the respiratory region. The upper portion of the Schneiderian membrane is known as the olfactory portion. The epithelium here is non-ciliated, and there are in this situation peculiar cells, presumably connected

with the terminal fibrils of the olfactory nerve. The ultimate filaments of this nerve are distributed over the upper third of the septum, over the roof of the nasal fossa, and extend on to the surface of the superior turbinated bone, and in part on to the middle turbinated bone.

Nostoc, a genus of blue-green Algæ (q.v.), the type of the order *Nostocaceæ* and of the sub-class *Nostochineæ*. Of the numerous species a few swim freely in fresh or brackish water; but most are terrestrial, growing on wet rocks or even on comparatively dry soil or within the tissues of other plants, such as the Rhizocarp *Azolla*, *Anthoceros* and other Hepaticæ (q.v.) and duckweed. In most species one or more interwoven *filaments*, made up of minute round cells, are enclosed in a gelatinous mass, known as the *thallus* or *frond*, which is formed by the coalescence of sheaths originally enclosing each filament. These masses are green, blue, or violet, hardened externally in the terrestrial species, and sometimes an inch or more across. *Nostoc commune*, appearing on gravel walks, after a shower, where unnoticed before, is sometimes known as "Falling stars."

Nostocaceæ. [NOSTOC.]

Nostradamus, the name assumed by MICHEL DE NOTREDAME (1503-66), a French astrologer of Jewish descent, born at St. Remi, in Provence. After taking the degree of doctor of medicine at Montpellier (1529), he practised in various French towns, finally settling at Salon, near Aix (1544). He signalled himself by his devotion to sufferers from the plague at Lyons. The first edition of his famous *Centuries* was published in 1555. He became royal physician on the accession of Charles IX.

Notables. This means literally the most notable or important men in a state. In France, where alone the term was used, it meant the members of an extraordinary board of deputies, who were appointed and convoked by the king. The first important assembly was held in 1558, but the two most important were those in 1787 and 1788, which were convoked by Louis XVI. in view of the crisis then at hand. The assembly of 1787 consisted of 144 persons, mostly nobles and divines.

Notation may be said to be the use of definite symbols for the representation of definite things. Although symbols are of great importance in chemistry, music, and mathematics, yet in this article we shall only deal with those which have been commonly used in counting. It must have always been necessary to have some means of representing quantity, and so we find that in the very earliest times—long before the growth of writing—certain signs were used to denote numbers. It was natural that the fingers should first be enlisted as symbols, and counting by these appendages in the course of time developed into an intricate system of reckoning. In its primitive form it is found now among certain savage tribes, and it is remarkable to note that savages, as a rule, can only deal with very small numbers. Elaborated to a finished system of calculation, it is seen in certain provincial villages in Europe itself,

where the different positions of the fingers—obtained by bending or closing them—are capable of expressing numbers up to 10,000. The fingers, however, though useful for expression, were useless for record, and so a system for expressing numbers by strokes grew up. This was obviously cumbrous for large numbers, and soon different symbols were employed to stand for such numbers as 5, 10, 100, etc. The Babylonians represented all numbers below 100 by two symbols only—for 1 and 10—these being repeated as many times as the number required; larger numbers were, in fact, obtained simply by the addition of smaller ones. Soon, however, multiplication began to be used. In the Syrian system (derived from the Egyptian), as well as in the Babylonian, a sign put to the left of the symbol for 100 denoted the number of hundreds meant. As writing became general, the alphabet became a field for symbols. Sometimes the letters taken in order represented the numbers also in order, as in the Ionic system; and sometimes the initial letter of the word signifying the number was used to denote it, as in the "Herodian" system of the early Greeks. Later the Greeks, like the Hebrews, took certain of their letters to denote the numbers from 1 to 9; others represented 10, 20, 30, and so on, while further letters were used to signify the hundreds. The Roman system is familiar to all. Before the letters "C" and "M" (the initials of *centum* and *mille*) were used, however, we find a circle divided in different ways representing 100 and 1,000. The sign \odot for 1,000 may have given rise to the form (I), and half the sign would be \odot the symbol for 500. Some people think that "M" itself comes from the old sign and not from *mille*. The sign \oplus for 100 may also have given rise to \perp or \angle for 50. It gradually became evident to the Greeks and Hebrews that high numbers could be expressed by merely altering the position of the symbols of the lower ones, and from this time onwards notation assumed an easy form.

For a long time numbers had been mechanically represented by means of counters placed on a kind of table known as an abacus (q.v.). The use of an abacus with nine ciphers instead of the counters seems to have been known in Europe in the tenth century, before the complete modern system was introduced. This complete system came into use in the twelfth century and differed from all previous ones in having the sign 0. Until then no zero had been used, so it was not always clear whether a symbol meant a certain number or ten or a hundred times as much. The system with the zero seems to have originated in India, to have taken root in Arabia in the ninth century, and from thence progressed to Europe.

Besides this decimal system, we still have a trace of a sexagesimal system in the division of time and in the graduation of the circle. This method was in use among the Babylonians, who reckoned in powers of 60.

Notochord, the cartilaginous rod which lies under the main nervous system, and is the primitive element of the skeleton, in the phylum of animals known as the Chordata (q.v.). It extends typically

from one end of the body to the other as a cylindrical rod tapering to a point in either direction; as such it occurs in the remarkable *Amphioxus* (q.v.) or Lancelet. In the Ascidians or Tunicates it is restricted to a short mass underlying the nerve cord in the caudal or tail section of the body. In the vertebrata, on the other hand, the skeleton is developed and encroaches upon the continuity of the notochord; it completely atrophies in the skull except in the sturgeon and the lampreys. It may persist as a series of soft disconnected masses between the bones of the back-bone or vertebral column, as in fish, or may be entirely lost. The Chordata form a phylum of the animal kingdom based upon this structure; it is divided into three sub-phyla: (1) the Urochorda, including the Ascidians, in which the notochord is restricted to the caudal section; (2) the Cephalochorda, comprising only *Amphioxus*, in which it extends throughout the body; and (3) the Vertebrata, including the fish, reptiles, amphibia, birds, and mammals in which the notochord is lost wholly or in part, owing to the development of a body skeleton. A structure in *Balanoglossus* (q.v.) has been identified as a notochord, and this group of worms therefore included among the Chordata; this view, however, is not now accepted.

Notogæa, Huxley's southern zoological division of the land surface of the globe, corresponding to Sclater's Neotropical and Australian regions. [ARCTOGÆA.]

Notornis, a genus of large flightless Rails, with one species, from New Zealand. It probably became extinct within the last half of the present century.

Notoryctes, a mole-like marsupial (*Notoryctes typhlops*), from Australia, forming a family (*Notoryctidae*) of polyprotodont marsupials. It was described by Professor Stirling in 1891 and by Dr. Hans Gadow. (*Proc. Zool. Soc.*, 1892, pp. 361-70.)

Nottingham, the capital of Nottinghamshire and a county in itself, is a parliamentary and municipal borough on the N. bank of the Trent at the S.W. extremity of Sherwood Forest, 15 miles E. of Derby and 126 N.W. of London by railway. Originally a Roman settlement, it became the Mercian Snotingham or "home of the Snotings." During the reigns of Ethelred I. and his successors it was frequently occupied by the Danes, who were finally expelled in 940. In modern times the progress of the lace and hosiery manufactures has given Nottingham a leading position amongst commercial towns. At University College (1879-81) instruction is given in connection with the University Extension scheme; the building also includes a free library and a natural history museum. The cruciform church of St. Mary is a fine specimen of Perpendicular architecture. The grammar-school, founded 1513, was reorganised as a high school in 1882. Nottingham possesses the largest market-place in England ($5\frac{1}{2}$ acres). The arboretum (17 acres) forms an attractive pleasure-ground. Nottingham Castle occupies the summit of a precipitous sandstone cliff overlooking the

Trent; the original Norman fortress was in 1674 replaced by the mansion in classical style of William Cavendish, first Duke of Newcastle, much injured by fire during the Reform riots 1831, restored in 1878, now used as the municipal museum and art-gallery.

Nottinghamshire, a north-midland county of England, bounded N. and N.W. by Yorkshire, E. by Lincolnshire, W. by Derbyshire, and S.E. and S. by Leicestershire; area, 824 square miles. It is 50 miles long from N. to S., with an extreme breadth of 25 miles. The Trent enters the county from Derbyshire near the S.W. extremity, and flows N.E., and then N. into Lincolnshire; its principal tributaries are the Soar, Erwash, and Idle. The E. part of the county, comprising the valley of the Trent and the Vale of Belvoir, is flat, and at the N. extremity is the Misson Level or Car, which up to 1796 was a swamp. S. of Nottingham are the wolds, consisting of moorland and grassy uplands. Elsewhere the surface is undulating and well-wooded, especially in the W., which includes a great part of Sherwood Forest. The Nottingham and Grantham and Fosse Dyke Canals afford communication between the Trent and the Witham. The geological formation consists of old red sandstone and magnesian limestone, with a substratum of coal in the W.; in other parts are quartz, gravel, marl, lias, and new red sandstone. The soil is, on the whole, not very productive. Corn and green crops are grown extensively, and there are many market-gardens and orchards. There are numerous coal-mines. Leading industries are hosiery and lace manufactures. The county contains the parliamentary and municipal borough of Nottingham and the municipal boroughs of Newark and East Retford.

Novalis, the pseudonym of FRIEDRICH VON HARDENBERG (1772-1801), one of the founders of the German romantic school, born in Prussian Saxony. At the university of Jena, which he entered in 1790, he came under the influence of Fichte, and formed an enduring friendship with Friedrich Schlegel. After residing at Arnstadt and Weissenfels he settled in Freiberg to study mineralogy, but his career was soon cut short by consumption. Among the friends of his later life were A. W. Schlegel and Tieck, the latter of whom edited his works in conjunction with Fr. Schlegel. His philosophical romances *Heinrich von Ofterdingen* and *The Pupil at Sais* show a deep sense of the beauty and mystery of the universe and a conviction that moral truth is known by immediate intuition and not through any intellectual process. He also wrote *Hymns to the Night* recording his sorrow at the death of his first love, and philosophical, critical, and moral fragments.

Nova Scotia, a province of the Dominion of Canada, between lat. $43^{\circ} 25'$ and 47° N. and long. $59^{\circ} 40'$ and $66^{\circ} 25'$ W., comprising the peninsula of Nova Scotia and the island of Cape Breton, which is separated from its N.E. coast by the narrow strait of Canso; total area 20,907 square miles. The peninsula is 250 miles long from N.E. to S.W., with an extreme breadth of 100 miles, and is connected with New Brunswick at its N.W. extremity by an isthmus about 16 miles in width.

The other boundaries of the peninsula are Northumberland Strait, which separates it from Prince Edward Island, on the N., the Bay of Fundy on the W., the strait or "gut" of Canso on the N.E., and the Atlantic on the E. and S. The lakes, with the rivers flowing from them, which seldom exceed 50 miles in length, extend over about 3,000 square miles. The largest, Lake Rossignol, in the S. part of the peninsula, is over 20 miles long. Great Bras d'Or Lake (500 square miles) in Cape Breton is a lake only in name, since it communicates with the sea through Little Bras d'Or Lake. There are several ranges of lofty hills, which for the most part run parallel with the coast; the highest points (1,100 to 1,200 feet) are in the Cobequid Mountains, near the New Brunswick border on the N. side of Minas Basin, an arm of the Bay of Fundy. The coast is much indented, especially on the S.E., where there are many fine harbours, such as that of Halifax, and Mahone and Margaret's bays. A vast collection of small islands runs along the whole of the Atlantic seaboard. Sable Island, a long narrow stretch of sand at the S. extremity, has been the scene of many shipwrecks. The climate is, on the whole, temperate, and the province is remarkably fertile, the best soil being that of the broad valleys between the hill ranges. There is also a rich tract along the shores of Minas Basin due to the marine deposits which remain after the "bore," when the tide sometimes rises 50 or 60 feet. Hay is the principal crop, and garden fruits, especially apples, are extensively cultivated. In the valley of the Annapolis orchards extend along the roadsides for over 50 miles. At the Government Agricultural College near Truro an education in farming and household management is given to members of both sexes. There are extensive coal-fields in Cape Breton and the N. part of the peninsula, and gold and iron are also worked. The fisheries are second only to those of Newfoundland. Manufacturing industries have advanced considerably of late years. The length of the railways is 700 miles. The provincial government is administered by a Lieutenant-Governor, assisted by an Executive Council of nine members. There are a Legislative Assembly of 38 members elected at intervals of four years, and a Legislative Council of 17 members. The province sends 10 senators to the Upper and 21 members to the Lower House of the Dominion Parliament. Nova Scotia was discovered by the Cabots 1497. New Brunswick was separated from Nova Scotia 1784; Cape Breton also formed a separate colony from that date to 1819.

Novatian (b. circa 200), the first anti-Pope, was an heresiarch of Montanist or ultra-ascetic views. The place of his birth is unknown. He was converted from paganism after a severe mental conflict, and ordained priest by Fabian, Bishop of Rome. During the Decian persecution he opposed the readmission of the lapsed into the Church, and was led by the difference of their views on this question to oppose Cornelius, Fabian's successor (251). He was himself consecrated Bishop of Rome by some of the party who seceded with him and who became known as Novatians, though the

title they gave themselves was *Cathari* ("the pure"). This sect was still in existence at the close of the 6th century.

Nova Zembla (Russian, *Novaya Zemlya*, "New Land"), a prolongation of the Ural Mountains, consisting of two islands in the Arctic Ocean between the Kara Sea on the E. and Barentz Sea on the W. Their united length is 600 miles and their average width 60 miles; they are of nearly the same size, and are separated by a narrow channel called the Matochkin Shar. Between Nova Zembla and Vaygach Island, off the mainland, is Kara Strait, 30 miles in width. The ice is in large measure dispersed by a current which flows on in continuation of the Gulf Stream, striking Nova Zembla on the N.W. The fauna and flora are very limited, and there are no settled inhabitants, but a permanent Russian fishing station was established about 1877.

November, the ninth month in the old Roman year (which began in March), and the eleventh month in the new Roman and English years.

Novgorod, a government of north-west Russia, between lat. 57° and 61° N. and long. 30° and 40° E.; area 47,236 square miles. There are many lakes, marshes, and large forests. The capital *Novgorod* ("New Town"), situated at the point where the Volkov flows from Lake Ilmen, is one of the most ancient cities in Russia. It was at the invitation of its inhabitants that Rurik (q.v.) crossed the Baltic about 862. It formed a connection with the Hanseatic League, and became a wealthy republic, till its prosperity aroused the envy of Ivan III., who almost completely destroyed it in 1471. It has now little trade. Among its ancient buildings the most important is the church of St. Sophia, built in imitation of that at Constantinople.

Novotcherkask, capital of the south Russian government of the Don Cossacks, stands on a hill of 300 feet, near the junction of the Aksai and the Don, 40 miles from the Sea of Azov. The town dates from 1805, when the inhabitants of Old Tcherkask were driven hither by floods.

Noyades ("drownings"), a method of executing persons, practised at Nantes during the Reign of Terror. The victims were bound and stripped in a boat with a movable bottom, the boat was taken into the middle of the river and the bottom suddenly opened.

Nubia, a region of somewhat vague extent, stretching from Egypt on the N. to Kordofan and Abyssinia on the S., and embracing the Nile Valley and the country on either side of the Red Sea on the E. and the Sahara Desert on the W. Assouan, in lat. 24° N., is the N. limit, and the S. may be fixed at about 14° so as to include Khartoum and Upper Sennaar; the latter districts form part of the Egyptian Soudan, but this name is now applied to the whole of the territory properly known as Nubia. In general Nubia consists of an irregular strip of fertile land from a quarter of a mile to four miles wide, formed by the windings of the Nile, around which on all sides are deserts, the Great Nubian Desert on the E. being of rocky and

stony character, whilst that of Bayudah on the W., within the great bend of the Nile, resembles a sandy steppe, with a scanty growth of mimosas or sedgy grass in favourable spots. The general barrenness is relieved only by an occasional *wady* or oasis except in S.E., where is a fertile district, watered by the Atbara. Elsewhere there is little vegetation beyond the mimosa, palm, and senna plant.

Nubians, a historic Negroid people, who give their name to the land of Nubia (q.v.). Here they form three distinct groups, speaking well-marked dialects of a common stock language: (1) *Mattokki* (*Bani Kenz*) from Egypt to Korosko; (2) *Saidokki* (*Mahai, Marisi*) from Korosko to Wady Halfa (second cataract); (3) *Dongolawi*, thence to Meroe. The Nubians, who now call themselves *Barabira*, are fundamentally of Negro stock, speaking a language closely related to that of the pure Negro *Nubas* of south Kordofan, whence they migrated to the Nile Valley, where the *Nubæ* are already mentioned as "a great nation" by Strabo. In this region they have intermingled with the Hamitic Blemmyes (Bejas) and the Semitic Arabs, so that the type is now greatly modified, though still distinctly Negroid—deep bronze or mahogany colour, woolly or strongly frizzled black hair, tumid lips, very large black eyes, scant beard worn under the chin like that of the Ethiopians on the Egyptian temples. All are agriculturists and Mohammedans since the 14th century, when their Christian kingdom of Dongola was overthrown by the Arabs after flourishing for over 700 years. The Mahdi, Mohammed Ahmed, was a Nubian of Dongola; in recent years the Nubians have taken active part in the political movements and conquering slave-hunting expeditions of Eastern (Egyptian) Sudan.

Nucleus, a structure occurring in almost every cell (q.v.), whether animal or vegetable, and now recognised as of the highest importance in the life of the cell. The division of the protoplasm in cell-division is generally preceded by that of the nucleus, and it has been observed that, whilst a mass of protoplasm escaping from a broken cell of the alga *Vaucheria*, if it contain a nucleus, will form a cell-wall and grow into a new plant, if it contain no nucleus it will simply decompose. Every nucleus apparently originates from the division of a pre-existing one, and, whether animal or vegetable, goes through an identical series of changes in itself dividing. It is denser than the protoplasm (q.v.), contains more phosphorus, and is more deeply stained by carmine. It has a limiting membrane or *nuclear wall* of a reticulate character, with more fluid contents, and contains two or more rounded bodies known as *nucleoli*. Though rounded when the cell is not dividing, it becomes spindle-shaped, and is then constricted into two spindle-shaped parts before dividing, whilst the granules of the protoplasm group themselves in plume-like lines radiating from its extremities like iron-filings in the magnetic field. These groupings are known as *karyokinesis* or *karyolitic figures*. The term *nucleus* was also applied to the body of the ovule (q.v.) as distinct from its coats; but, to avoid ambiguity, this structure is now preferably

known as the *nucellus* or *tereine*. Every animal begins life as a simple cell [EMBRYOLOGY and CELL], while some animals (all in the phylum Protozoa) remain permanently in this form. One part of the cell is always separated from the remainder as a compact dark spot, which is known as the nucleus. In its simplest form this is merely a rounded spot which is homogeneous in composition; the material of which it is composed is called nuclein or chromatin. The latter name is given to it from its property of absorbing staining reagents much more readily than the rest of the cell. In most cases the nucleus is constructed on a more complex plan. The nuclein is arranged into a long thread, which may be twisted into an intricate series of knots or woven into a reticulate meshwork. The spaces between the nuclein threads are filled with a fluid material known as caryoplasma or achromatin, the latter name being derived from the fact that it is not readily coloured by staining reagents. The nucleus plays an important part in the division of the cells in their multiplication. There are certain bodies resembling cells in all respects except in the absence of a nucleus. Such are known as cytodes. The term nucleus is also used in zoology for a few other structures, such as the digestive organs of salpa.

Nuculane, a succulent or berry-like fruit (q.v.), different from the true berry in being "superior," formed, that is, entirely from carpellary structures, and from the drupe (q.v.) in originating from more than one carpel and having no "stone" or hard endocarp. It is a type of fruit occurring in many widely-different orders and exhibiting considerable variety. It has generally a thin outer skin or epicarp; but this is often hardly separable from the pulpy interior. In some passion-flowers this exterior is tough almost to brittleness; and in the variety known as a *hesperidium*, the fruit characteristic of the orange tribe, it is thick and leathery. Other examples are the tomato and other Solanaceæ, asparagus and lily-of-the-valley.

Nudibranchiata, a term once used for all the slug-like Gastropoda (q.v.), but which is now abandoned, as the members of it have been distributed between two separate divisions of the order Euthyneura. Thus some, such as *Aplysia* and *Doris*, belong to the sub-order Opisthobranchia (q.v.), and others, such as the slugs *Arion* and *Limax*, to the sub-order Pulmonata (q.v.).

Nuer, a large Negro nation, who occupy the swampy region of the Upper Nile near the Bahr-el Ghazal and Sobat confluence, south of the Shilluks and conterminous with the Dinkas, whom they resemble in their remarkably long legs and broad flat soles, useful in traversing the quagmires of their watery domain. The Nuers pay great attention to their head-dress, which they build up into fantastic shapes, while the young women pierce the upper lip for the insertion of a bone or ivory rod, two or three inches long, covered with bright glass beads. Like the Dinkas, they own numerous herds of magnificent cattle, which they tend with great care, though living mostly on fish, corn, and roots. There

are numerous tribal divisions, all of which retain the patriarchal system of government, every village community having its distinct *bengdid*, or "lord," who is regarded as head of the family, controlling all domestic and general affairs. (Schweinfurth.)

Nuisance may be either public or private. (1) A public or common nuisance is an act by which the enjoyment of a right is interfered with, such as the right to light and air, to travel, not to be exposed to danger from infectious-disease, etc. Accordingly the carrying on of a manufacture from which noxious exhalations are emitted, or the exposure for sale of unwholesome food, or the stopping or obstructing a highway, etc., are public nuisances. The remedy for a public nuisance (which ranks criminally as a misdemeanour) is by indictment or information; and, if special damage is caused, an action for damages or injunction will lie against the wrong-doer. Modern legislation has also provided a summary way of dealing with nuisances; for by the Public Health Acts, local sanitary authorities are required to ascertain by inspection what nuisances exist within their districts, and the justices are empowered to deal summarily with such as are found to exist. (2) A private nuisance is such a continuous infringement of a natural right of property as could, in process of time, give the wrong-doer an easement or prescriptive right to do an act which was originally tortuous. Thus, if a man builds his house so close to his neighbour's that his roof overhangs it, or if he carries on a noisy or offensive trade, these are nuisances for which an action lies. The remedy for a nuisance is either by abatement or by action for damages, injunction, or mandamus.

Nullipores. [CORALLINES.]

Numa Pompilius, the second mythical King of Rome, was born at the Sabine town of Cures, and reigned 43 years. Aided by the counsels of the nymph Egeria, whom he met in a grove near the city, he established the chief religious orders and ceremonies, reformed the calendar, and laid the foundation of a civilised mode of life.

Numbers may be divided into two classes. If a number contains no factor greater than unity it is said to be prime, while one which is divisible by other numbers is said to be composite. Two numbers which have no common factor are said to be prime to each other. From these definitions arise a number of elementary theorems, among which are the following:—(1) If a prime number, a , divide a product, $b c d$, it must divide at least one of the factors, b, c, d ; (2) if a number be prime to two other numbers, it must also be prime to their product; (3) if two numbers be prime to each other, their squares, cubes, etc., are also prime to each other; (4) a number cannot be decomposed into prime factors in more ways than one; (5) the number of primes is unlimited; (6) no formula can be found expressing prime numbers only. Numbers can be expressed by many different algebraic formulæ which are useful for the determination of the properties of, and theorems relating to, numbers. Thus we can quite easily find the sum of any

series of consecutive numbers starting from unity, or the sum of their squares or cubes, and still more simple is it to find the number of divisors which any number can have. The product of any two consecutive numbers is divisible by 2, the product of any three consecutive numbers is divisible by 6, that of any four by 8, and so on. The theory of numbers is, however, very extensive, and includes the theory of equations, so that it forms an important branch of algebra. Numbers have been studied from very early times, while Fermat, Euler, Legendre, Lagrange, Gauss, Cauchy, etc., have greatly extended the science. Many theorems are known by the names of several of these illustrious mathematicians.

Numidia (Greek *Nomadia*, "land of Nomads"), in ancient geography, was a territory of north Africa between Mauretania on the W. and the Roman province of Africa on the E., corresponding roughly to the modern Algiers. Numidia became a formidable antagonist of Rome under Jugurtha (q.v.) and Juba I.; after the defeat of the latter in 46 B.C. it was formed into a Roman province. When Juba II. was made King of Mauretania by Augustus, western Numidia was incorporated in his dominions, and the name was henceforward confined to the east part of the former province.

Numismatics, the science which deals with coins and medals, especially with regard to their classification and history. Coins in numismatics mean those pieces of metal which are circulated as money, whilst medals mean those which are made to celebrate some person or event, although some collectors often call ancient coins medals. The science is very important, because very often coins are the only means by which we can trace the history of kings and countries.

Nummulites, a genus of large foraminifera, which is the type of the family *Nummulitidæ*. The genus is now extinct, but was very abundant in the Eocene, during which it built up enormous masses of limestone, known as the Nummulite limestone.

Nummulitidæ, the family of Foraminifera (q.v.), including the highest and largest members of this class. The characteristics of the family are that the shell is composed of carbonate of lime and is punctured by a large number of minute tubuli. It consists of many chambers, which are separated by walls thickened by an intervening layer known as the supplementary skeleton; the chambers are connected by a branching canal system which ramifies through this layer. The chambers are usually arranged in a flat spiral. The family includes three sub-families: (1) the *Fusulininæ*, now extinct, but which formed great beds of limestone in the Carboniferous period; (2) *Cyclolypeinæ*, including the genus *Orbitoides*, which is common in Cretaceous and Tertiary rocks; and (3) the *Nummulitinæ*, of which *Nummulites* is the type-genus. *Amphistegina* is representative of another group of this sub-family. The main interest of the Nummulites is geological, as they lived in such vast numbers in the seas of former periods that their shells form extensive

sheets of limestone, *e.g.* the Nummulite Limestone of the Mediterranean and Indian Eocene systems.

Nun, the common name applied to various orders of women who are devoted to religious lives under vows of poverty and celibacy. They are the correlatives of monks, and live in nunneries under the orders of a superior, who is called an abbess.

Nupe, a large and formerly powerful Negro nation, whose territory extends along the left bank of the Niger from above the Benue confluence to the Bussa Rapids, about 10° N. lat. The old Nupe kingdom was overthrown about 1825 by M'allam Dendo, nephew of Osman dan Fodyo, founder of the Fulah empire of Sokoto. Since that time most of the Nupe people, formerly pagans, have become Mohammedans, and their Emir (prince), a descendant of Dendo, is one of the most powerful vassals of Sokoto. He favours British interests above those of all other Europeans in the Niger basin, and has recently accepted the protectorate of the Royal Niger Company with the sanction of the paramount ruler of Sokoto. The Nupe, a branch of the widespread Yoruba race (*q.v.*), are a peaceful, industrious people, occupied in trade and agriculture, skilled weavers, blacksmiths, and potters. Bida, capital of their principality, though of recent foundation, is one of the great cities of west Africa.

Nur ed-Din Mahmud, MALEK AL ADEL (1117-73), was born at Damascus, and in 1145 succeeded his father, Omad ed-Din Zenghi, who had rebelled against the Seljuks, as sultan of north Syria. Nur ed-Din made Aleppo his capital, and gradually extended his dominions, repelling the 3rd Crusade and seizing the Christian fiefs in Syria. Damascus, a Seljuk possession which was virtually independent, fell into his hands in 1153. His designs on Egypt were forestalled by his nephew Saladin (*q.v.*), and war between the two would probably have ensued if the life of Nur ed-Din had been prolonged. He was an enlightened ruler, who endeavoured to promote the welfare of his subjects.

Nuremberg (German, *Nürnberg*), a picturesque old city of Bavaria, on the Pegnitz, in the province of Central Franconia, 95 miles N.N.W. of Munich. Most of the houses date from the 16th century, and the mediæval appearance of the town has been preserved by imitating the old style of architecture, with its red-tiled roofs, oriel windows, and high sharp-pointed gables facing the street. The old double wall retains nearly 100 of its turrets, besides several gateways; the fosse has been converted into gardens. The fine old Burg or royal palace, originally built by Conrad II. (*circa* 1024) has been little changed since the reign of Frederick Barbarossa (*circa* 1158). Of the churches the most notable are those of St. Lorenz, St. Sebald, and Our Lady, dating from the 13th to the 15th century. The town hall (1616-19), in Renaissance style, has frescoes by Dürer. The modern buildings include a Germanic National Museum (1852), a Bavarian Industrial Museum (1877), and a library of 70,000 volumes. The houses of Albert Dürer, Hans Sachs, and many families of mediæval renown are still in existence. Nuremberg was made a free imperial

city in 1219, and, owing both to its native manufactures and its position in the great commercial highway from the Levant to western Europe through Italy, became an extremely wealthy town, reaching the height of its prosperity in the 16th century. It was one of the first places N. of the Alps to come under the stimulating influence of the Renaissance, and it occupies an important position in the history both of art and of literature. Nuremberg is now the leading commercial town of Bavaria, with manufactures of children's toys, chemicals, lead-pencils, etc.

Nurhag, a prehistoric monument peculiar to Sardinia, where some thousands occur. They are round towers, of one, two, or three storeys, with sloping sides, the height being generally equal to the width of the base. A staircase leads to a platform on the top. Nothing is known of their origin or purpose. The talyots of Majorca and Minorca bear some external resemblance to these towers; but it is not known whether they possess a staircase, and there is always a table formed of an upright flat stone, with a similar stone crossing it.

Nursing Mission. [RED CROSS.]

Nut, in the strict botanical sense, is a dry, inferior, syncarpous one-chambered fruit with a hard exterior not splitting when ripe. The term is, however, in ordinary language and in commerce extended to many other structures, such as the seeds of the chestnut, the Brazil-nut, the nutmeg, or some pines, the endocarps of the almond, the cocoa-nut, and the walnut, and the pod of the ground-nut. The seeds of many nuts are rich in oil and in nitrogenous matters, and thus, though liable to become rancid, are valuable articles of food. Among the chief nuts used for food are the almond, Brazil-nut, cashew-nut, chestnut, cocoa-nut, hazel-nuts, hickory-nuts, nutmegs, pine-nuts, pistachio-nut, and walnut. Among those used as sources of oil are the almond, ben-nut, Brazil-nut, candle-nut, cashew-nut, cocoa-nut, palm-nut, and walnut. The coquilla-nut and corozo-nut, or vegetable-ivory, are so hard as to be turned into ornaments, and many others are used as beads; the poison-nut (*Strychnos Nux-vomica*) is used in medicine; the clearing-nut (*S. potatorum*), for clearing turbid water; the betel-nut, as a masticatory; and the marking-nut as marking-ink and varnish. Most of these are separately described. We import annually nuts used as food to the value of upwards of a million sterling, chiefly from Spain, France, and Brazil.

Nutation is a slight wavy motion of the earth's celestial pole which affects the regularity of the precession (*q.v.*). It is due to the fact that the earth is not a true sphere but bulges at the equator, and the moon attracts this equatorial excess of matter. If there were no precession, nutation alone would cause the earth's pole to be sometimes rather nearer to, and sometimes rather farther from, the pole of the ecliptic, a small ellipse being described between these two positions. The change in position varies with the motion of the moon's nodes, and as these nodes perform a

revolution in $18\frac{2}{3}$ years, that is also the time taken for the earth's pole to describe its small ellipse. The total effect of nutation and precession is to give the wavy motion above mentioned, the crest and trough differing by only $18''$ —the length of the longer axis of the ellipse. Small as is this inequality, which is strictly the lunar nutation, a still smaller wave motion is added, due to the position of the sun. This is the solar nutation. If we imagine small but regular ripples extending over the surface of a number of waves, then a particle made to travel over these ripples and waves would be moving in a manner representative of the resultant motion of our pole.

Nutcracker, any bird of the genus *Nucifraga*, of the Crow family, with four species ranging over the Palæarctic region to the Himalayas and the north of China. The bill is stout and conical, and the tail short and slightly rounded. The best-known species, *N. caryocatactes*, from the pine-forests of northern Europe and Asia, is an occasional British visitant. The length is about twelve inches; the plumage is thick and soft, for the most part shades of brown, plentifully marked with white spots, except on the wings, rump, and tail. *N. hemispila* is Asiatic.

Nuthatch, any bird of the Passerine genus *Sitta*, with seventeen species ranging through the Palæarctic and Nearctic regions to the south of



NUTHATCH (*Sitta caesia*).

India and Mexico. The nostrils are in a groove in the straight bill, the tail is short and broad, the legs short and stout, and the toes, of which the hinder is longer than the middle, armed with stout claws. The species are small, tree-creeping birds, generally nesting in holes in trees, and feeding on insects (in the search for which they prise off pieces of bark with their strong bills), seeds and nuts, and to their method of cracking the latter with blows of the bill they owe their popular names of Nut-hatch, Nuthack, and Nutjobber. The Common Nuthatch (*S. caesia*) is a British bird, by no means rare, but recognised with difficulty, except by practised eyes, owing to its shy nature and its coloration, which harmonises well with the hue of the bark of the trees on or among which it lives.

The length is rather less than six inches; the upper parts are slate-grey, with some black markings; the under-surface pale cinnamon.

Nutmeg, the kernel of the seed of *Myristica fragrans*, an evergreen tree native to the Banda Islands in the East Indies, growing under larger trees, in a light soil of volcanic origin, and in a climate of almost continuous rainfall. The fruit is pear-shaped and about two inches across. When ripe it splits, disclosing the scarlet aril or mace (q.v.). The seed has a thin hard testa enclosing the nutmeg, which consists largely of what is known to the botanist as ruminated perisperm, the inner integument of the seed being so folded inwards as to produce the mottled appearance seen in a cross section. These folds suggested a comparison with the stomach of a ruminant animal. The largest and roundest nutmegs are the best, and though generally about 110 to the pound, they may be as few as 68. They are often coated with lime, this practice, which is injurious to the flavour, having originated in the anxiety of the Dutch to secure their monopoly of the trade by destroying the germinating power of the seed. Nutmegs contain about 25 per cent. of *nutmeg butter* or *oil of mace*, a vegetable fat now considerably employed in soap-making. In the true nutmegs the fat contains about 6 per cent. of the volatile oil, which is mostly *myristicene* ($C_{10}H_{16}$); but the *long, wild*, or *male nutmegs*, mostly *M. fatua*, though containing the fat, have little fragrance or value as spice. We import from 400,000 to 800,000 lbs. of nutmegs annually.

Nutria. [COYPU.]

Nux Vomica. The product known in commerce under this name consists of the seeds of *Strychnos nux vomica*, a tree which grows in the southern hemisphere, Ceylon being one of its principal localities. These seeds contain amongst other constituents two well-known alkaloids, *brucine* and *strychnine*, to which their physiological activity and toxic properties are chiefly due. It is largely used as extract and tincture in pharmaceutical preparations, being a valuable nervous stimulant, and being frequently employed for this purpose.

Nyassa, a lake of East Africa, in the Zambesi basin, between lat. 9° and 14° S., and long. 34° and 36° E. Its elevation is about 1,550 feet, with a depth of over 140 fathoms in some places. The distance from north to south is 350 miles, and the average breadth about 40 miles. From the south extremity the river Shiré flows to the Zambesi. The lake was discovered by Livingstone in 1859.

Nyl-ghau, Nilghai (*Bosclaphus tragocamelus*) a large Indian antelope, most abundant in central India, frequenting wooded country, but often found in small herds in the open. The fore-limbs are longer than the hinder pair. The male stands about four feet high at the shoulder, is iron-grey in colour, and the horns, some eight inches long, curve slightly forward. The female, about one-third less, is hornless, and, like the young, of a bright fawn colour. Both sexes have a short, stiff

mane, and there is a tuft of hair on the throat of the male.

Nymphalidæ, the largest of the families of butterflies, containing seven sub-families. The main character is that the front pair of legs are generally rudimentary.

Nymphs, the minor Nature divinities of the ancient Greeks, the highest and most beautiful expression of the belief that natural phenomena were caused by the direct operation of spiritual beings. The Oceanides were the nymphs of the ocean, the Nereids of the Mediterranean, the Naiads of lakes and streams, the Oreads of mountains, and the Dryads or Hamadryads of woods and groves.

O

O, the 15th letter of the alphabet, and the only one which is not represented in the Egyptian hieroglyphics. It was probably invented at a later date by the Semites. The Semitic name denotes an eye. Before its adoption by the Greeks, who gave it its later value, its sound was like that of *h* in *house*. The vowel *o* is intermediate between *a* and *u*, and represents several varieties of sound, according as the cavity of the mouth is more or less contracted. Thus the sounds in *not* and *cord* are nearer to that of *o* than are those in *bone* and *pour*, for the formation of which the lips are more fully rounded. Numerous digraphs take the place of the *o* in *bone*—of *coal*, *soul*, etc. *O* also denotes the neutral vowel heard in *son*.

Oak, the English name for the genus *Quercus* which forms the type of the sub-order Quercineæ of the order Cupuliferæ, and includes nearly 300 species, mostly large trees, though in some cases mere shrubs, natives of temperate regions and moderate altitudes in the northern hemisphere. Their leaves are scattered, simple, and pinnately-veined, and have deciduous stipules. The species of warmer regions are evergreen, and have nearly entire leaf-margins, whilst the deciduous leaves of northern species are sinuate or cut. They are monœcious, bearing their male flowers in loose catkins and the female ones solitarily. The former have each a 5-7-lobed calyx and from 5 to 12 stamens; and the latter a 3-8-lobed calyx, a three-chambered ovary, and three styles. The ovary contains two ovules in each chamber, but becomes by abortion one-chambered and usually one-seeded. The fruit or *acorn* (q.v.), an inferior nut with a leathery exterior and enclosed below in a woody cupule or *cup*, is characteristic. This cup is formed by an outgrowth from the peduncle bearing numerous imbricate bracts. *Q. Robur*, one of the largest species of the genus, though known as the British Oak, ranges from Mounts Atlas and Taurus to lat. 63° N., about the limit of wheat-cultivation in Europe, and was revered for its fruit and timber alike by Greek, Roman, Celt, Saxon, and Norseman. Vast oak-forests covered central Europe at the dawn of history, and it is still a prevalent species in south Russia, Germany,

France, and England. Its wood, stained black and known as *bug-oak*, is found in prehistoric peat-bogs and in submerged forests. It was the favourite timber for ship-building and for domestic architecture among the Greeks and Romans. The tree sometimes reaches 100 feet in height and nearly 50 feet in girth, producing sound wood for 200 years; and, even when hollow, may retain its vitality for two or three centuries longer. The timber weighs



OAK (LEAF AND FLOWER).

about 50 lbs. per cubic foot or, in very hard slow-grown wood, nearly 60 lbs. When finely-grained, it is valued for furniture and carving. The bark has long been a valuable product, and until recent years was the chief tanning material of the world. In trees from 20 to 30 years old it contains from 7 to 10 per cent. of *quercetannic acid*. An immense variety of insects feed upon the oak, some of them producing galls [GALL-FLIES], such as the large spongy and rosy *oak-apples* and the small discoid *oak-spangles* on the leaves. Next in importance to *Q. Robur* among European oaks is the Turkey Oak, *Q. Cerris*. The evergreen or holm (holly) oak of southern Europe, *Q. Ilex*, grows to smaller dimensions, but has very dense wood. *Q. Suber*, whence we derive our supply of cork (q.v.), is a similar species with a more western distribution. The large thick acorn-cups of the Levantine *Q. Aegilops* and *Q. Vallonia*, with reflexed scales, are rich in tannin, and are imported under the name of *valonia*, their young acorns—also used for tanning—as *camata* or, when still younger, as *camatina*. *Q. infectoria* produces the *Aleppo galls*, of which we import about 1,000 tons annually for ink-making and dyeing. Of the numerous oaks of America—most of which are valuable as timber, though less durable than *Q. Robur*—the chief is the white oak, *Q. alba*; but several, such as *Q. rubra* and *Q. coccinea*, are grown in England, as scarlet-oaks for the autumn beauties of their leaves. We import over 100,000 loads of oak-timber annually, chiefly from the Continent and from North America, and about 30,000 tons of bark, chiefly from Belgium, in addition to a home supply of the latter of nearly ten times that amount.

Oakland, a city in Alameda county, California, U.S.A., stands on the E. shore of the bay, opposite

to San Francisco, of which it is almost a suburb, attracting many residents by its fine situation and handsome streets. Here the Central Pacific Railway has its terminus, and the pier, two miles long, affords facilities for shipping. Various industries exist, jute-spinning being the most important. The settlement was incorporated as a city in 1854.

Oakum, a mass of loose tarred fibres employed in ship-building for caulking the seams between the timbers of wooden vessels or between the planks in the decks of iron and steel ships. It is usually obtained by untwisting old ropes and then separating the fibres, a task which is frequently imposed as a penalty in gaols.

Oasis, a fertile spot in the midst of a desert, caused by the presence of a well or spring. The word is derived from the ancient Egyptian language, and was at first used only of such spots in the Libyan Desert. In Algeria the French have formed artificial oases by sinking artesian wells. By employing irrigation, barley, rice, and other cereals can be cultivated.

Oat (*Avena sativa*), a well-known and valuable cereal grass, having its spikelets in a loose panicle and a long awn (q.v.), projecting from the dorsal rib of its outer glume. It is probably a variety of the wild *A. fatua*, is found in Swiss lake-dwellings of the Bronze Age, and was used as a bread-stuff by the ancient Germans, according to Pliny. Oats are largely grown in Scotland, Ireland, and the north of England where wheat will not flourish, about 4 million acres, yielding from 38 to 40 bushels per acre, being generally under this crop in the United Kingdom. In 1890 we imported over 12½ million cwts. of the grain, chiefly from northern Europe. Oats are also largely grown in the northern United States. The straw is valuable for mixing with fodder, and the grain is the most valuable food for horses; but the meal is the staple food of man in many countries where wheat does not flourish. It is largely eaten as porridge, and, being richer in albuminoids, fat, sugar, and saline constituents than wheat, is of very high nutritive value. The whole grain, deprived of its husks, is known as *groats* or *grits*, and is used for gruel.

Oates, **TITUS**, was born about 1650. He was expelled about 1675-1676 from a naval chaplaincy. In 1678 he set about piecing together the story of a plot to murder the king, in which he did not hesitate to implicate the queen and the Duke of York. The story hit off the mood of the people, and, when the magistrate before whom the depositions were taken was murdered, and letters from the Duke of York's secretary were discovered asking for money from France, public indignation broke loose, and, in spite of all efforts to do justice, many innocent people were put to death on the flimsiest evidence. In a year the storm had exhausted itself and Oates retired into private life with a handsome pension. On the accession of James, Oates was tried for perjury, convicted, and sentenced to imprisonment for life, exposure in the pillory, and a flogging. He lived until 1705 in the enjoyment of

a pension granted by William III., and concocted another plot with the aid of William Fuller.

Oaths. An oath is a solemn asseveration made either by writing or word of mouth and attested by such solemnity as is binding on the conscience of the deponent. With Christians this solemnity is kissing the Holy Gospels; but in the case of persons holding conscientious views on the impropriety of oaths altogether, the "Oaths Act, 1888," enacts that every person, on objecting to being sworn and stating as the ground of such objection either that he has no religious belief or that the taking of an oath is contrary to his religious belief, shall be permitted to make his solemn affirmation, instead of taking an oath, in all places and for all purposes, where an oath is or shall be required by law and by the same Act. If an oath has been duly taken, the fact that the person taking it had no religious belief does not affect its validity. Besides this relaxation of the law on the subject, a statutory declaration has been substituted for an oath in non-litigious cases in many instances, but oaths when taken must be taken according to the form of each person's religious persuasion. Before an oath can be administered, it must be shown if any doubts exist that the witness is aware of the sanctity of the oath or, generally, that the Almighty will punish falsehood. Promissory oaths are those required to be taken by persons on their appointment to certain offices, as the oath of allegiance, of which the present form is:—"I, ———, do swear that I will be faithful, and bear true allegiance to Her Majesty Queen Victoria, her heirs, and successors, according to law." These oaths have been lately much revised. The Parliamentary Oaths Act, 1866, requires the oath of allegiance to be taken by members of Parliament before sitting or voting. The administering of unlawful oaths is an offence against the Government and punishable by penal servitude. Taking a false oath is perjury. [AFFIDAVIT, AFFIRMATION, DECLARATION, PERJURY.]

Ob, or **OBI**, a large river of Siberia, formed by the confluence of the Biya and the Katun, both of which rise in the Altai range. Leaving Chinese territory with a north-westerly course, it discharges its waters into the Gulf of Ob in the Arctic Ocean, draining an enormous area, and having a total length of over 2,000 miles. Its chief tributaries are the Irtysh, Tcharysh, Tom, and Tschulow, and the towns of Barnaul, Tomsk, and Naryn are on its banks. Some few river steamers ply on its waters, and recently Captain Wiggins has endeavoured to open them up to commerce from the sea.

Obadiah (*Abdias*, "servant of Jehovah"), the fourth and briefest of the minor prophets. Nothing is known of his personal history, and attempts to identify him with others of his name have failed. He probably wrote in the 6th century B.C.

Oban, a port and parliamentary borough, in Argyllshire, on the W. coast of Scotland. Delightfully situated in a deep recess of the Firth of Lorn, with a perfectly safe harbour, and surrounded by picturesque scenery, it has recently become a

great centre for tourists and yachtsmen. Steamers ply daily to Glasgow, 96 miles distant, and to the Caledonian Canal and Inverness, whilst a railway gives access to the central and eastern districts. Except fishing and whisky-distilling, there are no industries, but the trade is considerable.

Obelisk (Greek, "pointed pillar," originally "spit"), a four-sided tapering column with an apex of pyramidal form. The ancient Egyptian obelisks were usually monoliths, consisting of a single piece of red granite or syenite. The proportions of these obelisks were always nearly the same; thus the thickness at the base was about one-tenth of the height, and the diminution in thickness between base and summit usually varied from one-fourth to one-third. The pyramidion or cap was commonly covered with bronze or gold and on the faces of the shaft were carved inscriptions reciting the names and titles of kings. They are usually found in pairs in front of temples, and were probably erected in all cases to commemorate some particular event. Many of the Egyptian obelisks were removed to Rome, and the loftiest now existing, 108 feet in height, stands near the church of St. John Lateran. One of the two called Cleopatra's Needles was presented to Great Britain by Mehemet Ali in 1833; but its transport to England did not take place till 1878. This obelisk, $68\frac{1}{2}$ feet high, now stands on the Thames Embankment.

Oberlin, JOHANN FRIEDRICH, born at Strasburg in 1740, became a Protestant pastor at Waldbach, in the poorest part of Alsace. He set to work about the moral and material improvement of his flock, making roads, teaching agricultural science, and fostering education, with such success that his little community won the respect alike of the revolutionary party and the monarchists. In his beneficent task he was aided by his housekeeper, Louise Scheppler, a woman of remarkable character. Oberlin died in 1826.

Oberon (from *Auberon*, *Alberon*, Old French forms of German *Alberich*), the king of fairy-land and the husband of Titania. These sovereigns and the story of their quarrel and reconciliation are best known to English readers from the *Midsummer Night's Dream*.

Obesity, the term applied to the condition in which there is an undue accumulation of fat in the body. In some people there is a natural tendency, often hereditary, to corpulence, but in the majority of instances obesity is developed in persons of middle life who take little exercise and live well, and the condition is in them no doubt largely attributable to their habits. It is not usually recognised that with advancing years less food is required, and it often happens that those who lead the least energetic lives devote considerable attention to their diet. While, however, there can be no question that in the majority of cases corpulence is connected with over-indulgence in food, and is therefore most readily prevented by attention to this matter, in some instances anæmia is associated with the deposit of fat, and it occasionally happens that in the more extreme forms of obesity there are

forms of degeneration, affecting mainly the circulatory organs, which render it unadvisable that any radical method of treatment should be adopted save under good advice. Many plans of diet have been recommended in the treatment of obesity. They all agree in a considerable limitation of the amount of starchy and saccharine food prescribed—dry toast, biscuits, or rusks being recommended in place of ordinary bread, milk and sugar being prohibited altogether, and vegetables strictly limited in amount. By some much importance is attached to the strict limitation of the quantity of liquid, particularly at meals; others recommend that plenty of tea, coffee, water, and the like should be consumed; but nearly all agree in the recognition of the advisability of taking but little alcohol. Most authorities recommend that meat should be taken in small quantities, and not more than once a day.

While there are various views as to the quality of the food taken, there is a tolerably general consensus of opinion as to the quantity; and it is the height of folly for a patient to imagine that he can (by avoiding a few particular articles of diet) at one and the same time indulge largely in the pleasures of the table and grow thin. The famous formula of Mr. Banting, by means of which that gentleman was able to reduce his weight to the extent of nearly three stone, in the course of a year, has been adopted by many people since his time. He recommended: for breakfast, some 6 or 7 oz. of solid food (meat, or fish and toast), and 9 oz. of liquid (tea or coffee without milk or sugar); for dinner, 10 or 12 oz. of solid food, with 10 oz. of wine; for tea, 2 to 4 oz. of solid food (fruit and a rusk or two) with 9 oz. of tea; and for supper, 3 to 4 oz. of solid food, with 7 oz. of wine. This diet probably goes to an extreme in the exclusion of fat, and is somewhat liberal in the matter of alcohol. It suits some people, but it is advisable that a severe regimen should not be adopted save under medical advice.

Object-Glass is that part of a microscope or telescope which forms the first image of the object viewed. When a single lens is used as a magnifying-glass it may be said to combine the functions of both object-glass and eye-piece, and in this case the image formed is erect and virtual. [LENS.] In the case of microscopes and telescopes, however, the object-glass forms an inverted real image in the instrument, this image being viewed by the eye-piece. In all good instruments the object-glass is an achromatic combination of lenses, generally of flint and crown glass.

Oblations, or OBVENTIONS, are offerings or customary payments made to the minister of a church for marrying, burying, etc., and by way of "Easter offerings." Baptismal fees have been abolished by an Act passed in the present reign.

Oboe, or HAUTBOY, a wind-instrument of wood in which the tone is produced by means of a double reed of cane fastened by silk thread to a short metal staple. This staple is attached to the uppermost of the three joints of which the instrument, as now made, consists. The lowest joint has an outward curve like that of a bell. The compass

is commonly from B below the stave to F in alt. The oboe has a rich, though small, tone, and is used in the orchestra to give the pitch (in the key of C) to other instruments.

Obolidæ, a family of Brachiopoda (q.v.), belonging to the order Inarticulata or Tretenterata (q.v.), which lived only in Palæozoic times, where it ranged from the earliest to the Carboniferous ages. The family is allied to the living *Lingula*, but differs from the family of which that genus is the type, in the thickness of the margins of the shell-valves and the presence of a groove for the passage of the peduncle. The type-genus *Obolus* is Silurian.

O'Brien, WILLIAM SMITH, born in 1803, was educated at Harrow and Cambridge, entered the House of Commons for Ennis in 1826, and sat for county Limerick from 1835 to 1848. Except as to the removal of the Catholic Disabilities, he did not at first sympathise with O'Connell, but after the Arms Act of 1843 he joined the Young Ireland party, and in 1847 started the Irish Confederation. He was arrested and tried for sedition in 1848, but not convicted. In July he started his "War Directory," and began actual hostilities at Ballinacorney. A few troops soon dispersed his followers, and, being again tried, he was condemned to death, a sentence afterwards commuted to transportation for life. But in 1854 he was released, and fully pardoned in 1856, dying at Bangor, North Wales, in 1864.

Observatory is a place where astronomical observations are made. In the early ages astronomy was chiefly a subject in which speculation held sway, and any observations of the heavens were of an extremely rough nature. About 300 B.C., however, an observatory was founded at Alexandria, and from this time onward astronomy became more truly a science, with a tendency towards founding its laws upon observed phenomena, though for many hundred years a large amount of unfounded theory still accompanied it. Hipparchus and Ptolemy made great strides in the science at the Alexandrian observatory, but after the 2nd century A.D. it does not seem to have been used. About the 9th century, observatories began to be built in Arabia and the East, and in the 15th century the first one in Europe was erected at Nuremberg. From this time observations became much more exact, and Tycho Brahe in the 16th century at his own observatory started a series of consecutive records of the positions of different heavenly bodies. The utility of such records became at once apparent, and hence arose many national and public observatories, among the first being those of Paris and Greenwich. Such institutions are now to be found in almost every country of the world, one of the last being the Lick observatory (q.v.) in the United States. An enormous change has, of course, taken place in the instruments employed. The sextant and mural quadrant of Tycho Brahe have been succeeded by the transit instrument and the meridian circle, while the invention of the telescope added enormously to the field of observation. Errors in reading the instruments were lessened by the use

of micrometers, and time was more accurately measured when chronometers were improved. Not only are observations made on the sun, planets, and stars, but meteorological and magnetic phenomena are also recorded in many observatories. The work to be done is therefore enormous, and so it is often found advisable to have different observatories devoted to different branches of the work, the largest being generally those maintained for pure astronomical observations.

Obsidian, or VOLCANIC GLASS, said to have been named after its discoverer Obsidius, is a black, greenish-brown or grey glass, with a brilliant vitreous lustre, and breaking, like artificial glass, with a conchoidal fracture. It often exhibits streakiness or *fluxion-structure*, and is full of microliths, and may be spherulitic or vesicular. It is found in Iceland, the Lipari Islands, Mexico, and elsewhere. In composition it is acidic, corresponding closely with sanidine felspar (q.v.), and being, no doubt, formed by rapid cooling. The ancient Mexicans quarried it for arrow-heads and knives at the Cerro de las Navajas or "Hill of Knives." It is sometimes still cut and polished for ornamental purposes, as it was by the Greeks and Romans.

Obstetrics. This term derived from the Latin *obstetrix*, "a midwife," literally "one who stands by," is applied to the science and art of the treatment of childbirth, and the abnormal conditions and diseases associated with the same. This branch of medical knowledge has undergone wonderful development in the last two centuries. The ancient physicians devoted, it is true, some attention to the subject, but their notions were crude, and their practice necessarily therefore far from perfect. Throughout the Middle Ages scarcely any advance was made; men were jealously precluded from all study of the problems involved, and ignorance and superstition reigned supreme. In the 17th century, however, a new science of obstetrics gradually came into being, and systematic study was devoted to the subject, with the result that it is now an everyday occurrence for the life of an infant or of a mother to be saved by the art of the obstetrician.

In the large majority of cases labour is naturally performed without any artificial aid; but in some instances, whether it be from anomaly of the uterine contractions, from deformity of the pelvis, or from abnormality of the foetus, the unaided natural forces are unequal to the task of delivering the child. An important advance was marked by the discovery of the forceps by the Chamberlens early in the 17th century, and the instrument has undergone improvement from time to time. By means of the traction exerted by the forceps it is often possible to satisfactorily terminate labour in cases which without the assistance of the instrument would be fraught with danger to the mother or child or both. Sometimes *version*, i.e. the bringing about of a change in the presentation of a child, requires to be effected; and in rare instances when it is impossible to deliver a living child, the operation of craniotomy is performed. The induction of premature labour is indicated in cases of extreme pelvic contraction. The expulsion of the after-birth

is sometimes attended with difficulty, and disturbed contraction of the uterus after delivery may lead to bleeding (post partum hæmorrhage, as it is called), which is one of the most urgent conditions that a surgeon can be called upon to deal with. The use of anæsthetics has greatly facilitated the performance of obstetric operations and has materially diminished the difficulties in the treatment of labour. Puerperal fever, which in former days claimed many victims, is now, thanks to the use of antiseptics, comparatively rare.

Occlusion is the absorption of gases by metals, the phenomenon being specially remarkable in the case of platinum and palladium. A piece of red-hot platinum wire will dissolve about four times its volume of hydrogen, while warm palladium will hold as much as 643 volumes of that gas. If an electric current be sent through some slightly acidified water, and palladium used as the terminal at which the hydrogen would be evolved, the metal will occlude that gas until it is quite saturated with it, and will also swell in the process. Nickel under similar conditions will also absorb hydrogen. Meteoric iron is often found to contain a considerable volume of mixed gases, among which hydrogen is always found, it being often accompanied by nitrogen and carbon-monoxide.

Occultation of a heavenly body is said to occur when it is hidden from our view by another body; thus the satellites of Jupiter are occulted by the planet when they pass behind it. Since the moon is so large an object in our sky, stars and planets are frequently hidden behind her disc, and such occultations are extremely interesting. They can only occur in a zone of the heavens about $10^{\circ} 18'$ wide, since the moon's orbit is inclined at an angle of $5^{\circ} 9'$ to the plane of the ecliptic. A star appears to meet the moon at her eastern edge, to disappear for a short time, and then to emerge at her western edge, and, if the moon be full, nothing very remarkable is observed in the phenomenon. When, however, the moon is younger, there is a part of her edge on the eastern side which we cannot see at all, since it is not illuminated by the sun, but which is, of course, quite as effectual in occulting a star as the bright part; the star then suddenly disappears from view when it passes behind this unseen obstacle, and the effect is rather that of the star having mysteriously "gone out."

Ocean. [ATLANTIC, PACIFIC.]

Ocean Currents. [CURRENTS.]

Ocean Routes. [See Map, p. 193, vol. i.]

Ocellatæ, the small larval Medusæ or Jelly-fish, which are the young of the zoophytes known as the Tubularia (q.v.). They are provided with minute eye-specks, whereas the Medusæ, which are the larvæ of the allied group of the *Campanularidæ*, have auditory sacs and no eye-specks.

Ocellus, one of the simple eyes found in many of the Arthropoda. In this phylum the eyes occur in two distinct types. There is the compound eye, which contains a large number of distinct structures, each of which has all the elements of an eye; each element in this eye has its own lens, visual

rods, retinal cells, etc.; in one eye there may be thousands of these structures grouped into a mass. In the second place, there is the ocellus, which consists of one such structure placed by itself. In some of the simplest insects, such as the Collembole (q.v.), and in *Limulus* (q.v.), it is the only optical organ present. In others, such as the larvæ of the May-flies (*Ephemeridæ*) and many Arachnida, both types of eye are present; others, such as the larvæ of the Dermaptera or Earwigs, have only the compound eye.

Ocelot (*Felis pardalis*), an American tiger-cat (or perhaps several races or varieties), arboreal in habit, preying chiefly on birds, and ranging from Texas to Patagonia. Length, about 4 feet, of which the tail counts for one; fur, tawny or reddish-grey with black spots and blotches.

Ochino, BERNARDINO, born at Siena, Italy, in 1487, became first an Observantine and then a Capuchin friar, rising in 1538 to be vicar-general of the order. He was driven out of the Romish Church, joined Calvin at Geneva, and formed a Protestant congregation at Augsburg. In 1547 he came to England, and was made a prebendary of Canterbury, composing the *Tragedy*. On the accession of Mary he fled to Zürich, where he published the *Labyrinth*, assailing the Calvinistic doctrine of predestination and completing his severance from that party. Expelled from Switzerland, he took refuge in Poland, dying in 1564.

Ochreate, in *Botany*, signifies furnished with a sheath formed by a stipule or the union of two stipules, through which the stem passes.

Ochterlony, SIR DAVID, was born in 1758, and became a cadet in the East India Company's service, attaining the rank of general in 1803, when he served under Lord Lake in the Mahratta War. In 1814 he held a command of a division in the beginning of the war against Nepal, and subsequently took entire charge of the operations, which he brought to a highly successful issue in 1816, and was rewarded by a baronetcy. He died at Meerut in 1825.

Ockham, or OCCAM, WILLIAM OF, the name, derived from his birthplace in Surrey, by which one of the leading Schoolmen is known. In 1322 he joined in the revolt against Pope John XXII. and, after a brief imprisonment, escaped to Munich. Ockham was a Nominalist, and in his *Summa Logices* demolished Realism. He is best known popularly for the maxim (closely allied to Newton's First Rule of Philosophising), "Entia non sunt multiplicanda præter necessitatem." He also insisted on the rights of secular princes as against the Papacy. He is often styled *Doctor Singularis* or *Invincibilis*. He probably died in 1349.

O'Connell, DANIEL (1775-1847), "The Liberator," was born near Caherciveen in Kerry, and was educated (at the expense of his uncle, Maurice O'Connell, of Darrynane, who adopted him), first at a small Catholic school near Cork, and then (1792-93) at the colleges of St. Omer and Douai. He left early in 1793 upon the outbreak of the French Revolution, of which he saw enough to fill him with

horror. The following year found him a student of Lincoln's Inn, determined (as he himself expressed it) so to improve and enlarge his subordinate talents as to secure for himself something more than a subordinate position in his profession. In 1798, having left London, he was called to the Dublin Bar, at which he won a foremost position almost immediately, and became renowned for the sparkle and exuberance of his wit. In 1800 he was the principal speaker at a meeting of Catholics held to protest against the Union, and from this time he gave himself up more and more to Irish politics. The ill-starred efforts of the United Irishmen had induced in his mind the conviction that secret and illegal methods were vain and dangerous and that "all work for Ireland must be done openly and above-board." It was in this conviction that he set himself to the organising of the vast movement which was to have so triumphant an issue in 1829. The ground of its operations having been thoroughly prepared, the Catholic Association came into being in May, 1823. From the first it was under the absolute control and direction of O'Connell. It was entirely supported by popular subscription, was officered largely by the priesthood, and embraced the whole of Catholic Ireland. Some idea of its vastness may be got from the fact that on one day in January, 1828, as many as two thousand meetings were held in different parts of the country. O'Connell, emboldened by the success of the movement and availing himself of the anomaly which allowed of a Catholic's being returned as member of a Parliament in which he could not sit, decided to stand for Clare upon the seat's becoming vacant in June, 1828. The election resulted in a decisive victory, and Catholic emancipation followed almost as a matter of course: a revision of Catholic disabilities was recommended in the King's Speech of February, 1829, and in the following April the Emancipation Bill became law. O'Connell's election having preceded the measure, he was denied the right to sit in Parliament without taking the obnoxious oath, until he had again presented himself to his constituency and been again returned. This was in July, 1829, between which date and his death he represented successively Waterford, Kerry, Dublin, Kilkenny, Dublin again, and Cork. In Parliament, O'Connell sided with the Whigs until the outbreak of the tithe war, their earlier attitude in regard to which he strongly opposed; their later action in practically abolishing tithes and handing over the Irish Church surplus for secular use won them back his support. During the Reform movement he brought in a bill for universal suffrage, triennial parliaments, and the ballot. He first introduced the question of Repeal at the opening of Parliament in 1834, and challenged a division, which resulted in his defeat by 523 to 38 votes. In April, 1840, the National Repeal Association was founded, O'Connell relying on popular subscription for its support. This amounted in 1843—"the Repeal year," as O'Connell sanguinely called it—to nearly £50,000. In 1843 the Repeal agitation took the form of a series of enormous meetings in and near Dublin, presided over by O'Connell. In October, Peel, determining to crush

the movement, proclaimed a meeting which was to have been held at Clontarf. O'Connell decided that the meeting should be abandoned. He was arrested the following week on a charge of fomenting disaffection, was put upon his trial in January, 1844, was convicted, and sentenced to twelve months' imprisonment and a fine of £2,000, but the verdict, come to by a packed jury, was reversed by the House of Lords. With his submission in regard to the Clontarf meeting, O'Connell's influence, already weakening from several causes, was practically destroyed. He made his last speech in Parliament in February, 1847, and died at Genoa on the way to Rome in the following May. His heart, by his dying wish, was consigned to Rome, his body in the following August removed to Dublin and buried at Glasnevin.

The network of political associations which O'Connell created throughout Ireland, and the admirable order which characterised the immense mass meetings of the Repeal agitation, gave proof of his powers of organisation and his control over his followers. Of his oratory, and especially of the beauty and power of his voice, Bulwer Lytton, Disraeli, Lord Jeffrey, and Charles Dickens have left enthusiastic descriptions, and numberless instances have been given of his wit, whether in Parliament, on public platforms, or in courts of law. Though not blameless in private life, he was a devoted and affectionate husband and father; and a pleasing picture of his relations to his wife and children is afforded by the volumes of his *Correspondence*, published in 1890.

O'Connor, FEARGUS EDWARD, was born near Cork in 1796. He identified himself with O'Connell in politics, whereby he secured a seat for Cork in 1832. He soon broke with his leader, and joined the English Radicals, becoming the leader of the Chartists. Returned for Nottingham in 1847, he took a prominent part in the demonstration and monster petition of 1848, aiding the movement largely by the publication of the *Northern Star*. Failure unhinged his mind, and he died a hopeless lunatic in 1855.

Octavia, (1) daughter of Caius Octavius and sister of Augustus, was married early to Caius Marcellus, who died in 41 B.C. She then became the wife of Antony, thus reconciling him with her brother. (2) Daughter of the Emperor Claudius, who at the age of twelve was married to Nero (q.v.).

October (Latin "eighth") was the eighth month of the ancient Roman year. It became the tenth month, and was given thirty-one days, when the calendar was reformed by Julius Cæsar.

Octopoda, an order of Cephalopoda (q.v.), including the *Octopus* or Devil Fish (the "pieuvre" of Victor Hugo) and the *Argonauta* or Paper Nautilus. The nearest ally is the order Decapoda (q.v.), from which it differs in the possession of eight instead of ten arms; in that these bear sessile and not stalked suckers, that the arms are connected at their lower ends by a thin membrane, and that the eyes have a sphincter-like lid. There are three families:—(1) the *Cirrhoteuthidæ*,

of which the type is the genus *Cirrhoteuthis*, which is a small violet-coloured species from the coast of Greenland; (2) *Philonexidae* or *Argonautidae*, including the Paper Nautilus; and (3) the *Octopodidae*, including the typical genus *Octopus*. The Octopods have, as a rule, no shell; in most of the order this is represented only by a few internal, small, calcareous rods. In *Argonauta*, however, two of the arms are expanded at their ends, and the flat plate-like membranes thus formed are folded back, and secrete a shell over the hinder part of the body. This is present, however, only in the females. In most of the Octopods one of the eight arms in the males is specialised to serve as a reproductive organ; it is usually separated from the male during copulation, and when discovered by the Italian naturalist, Chiave was regarded as a parasitic worm and described under the name of *Trichocephalus acetabularis*. Aristotle, however, who described the Argonaut, seemed to have understood its proper function. The Octopods are all marine; they either live in holes under rocks, as *e.g.* the ordinary Octopus, or swim on the surface often far from land. The only fossil representatives of the order are some shells of the *Argonauta* from the Cainozoic deposits. *Octopus* is not uncommon round the English coast and in the Channel Islands.

Octopus. [OCTOPODA.]

Octroi, a French word derived from the Latin *auctoritas* ("authority"), originally denoted any grant or privilege authorised by Government. It afterwards came to be used only of the taxes in kind levied in France and other countries on goods carried within the gates of towns. The injurious effect of a tax of this nature on the internal trade of a country is obvious. The French octrois were abolished during the Revolution, but again introduced in 1798.

Ode (Greek *ōdē*, "chant") denotes literally any poem arranged to be sung to an instrumental accompaniment. Poems of this description were developed from the regular distich, the simplest form of verse, by Archilochus, who introduced the epode, and Alcman, who united a series of such movements in one complex whole. Out of this class of lyrics grew the two different kinds of "ode," in the narrower meaning of the term. The type perfected by the Lesbian and Æolian poets—Sappho, Alcæus, and Anacreon—is best known through the imitations of Horace, and is therefore called "Horatian." It was susceptible of much manipulation in the arrangement of its parts, yet it was always marked by a certain slightness of form and simplicity of construction as compared with the more elaborate Pindaric ode. The latter was the result of the modifications introduced into Alcman's ode by Stesichorus, Simonides, and Pindar. Stesichorus invented a threefold movement, the *strophe* being answered by the *antistrophe*, whilst both were in a manner repeated in the final *epode*. This form was adapted by Simonides to the requirements of Dorian music, and reached its full development in Pindar's *Epinikia*, odes of victory sung at the great national games.

The modern ode has been defined as "any strain of enthusiastic and exalted lyrical verse, directed to a fixed purpose, and dealing progressively with one dignified theme." Amongst these the English certainly hold the highest rank. They fall naturally into two divisions: those which follow the Horatian type, and those modelled, whether intelligently or through some mistaken notion, on the Pindaric. To the former class belong two of the earliest and most beautiful of English odes: Spenser's *Epithalamium*, and Milton's ode, *On the Morning of Christ's Nativity*. A new form—purely artificial in its apparent freedom—was unfortunately given to the ode through the influence of Cowley, who, failing to perceive the principle which regulated the construction of the Pindaric ode, imagined that it left the poet at liberty to follow his own fancy without any regard to rhythmic or other considerations. The precept and example of Congreve, who grasped the sequence of *strophe*, *antistrophe*, and *epode*, failed to stem the current fashion, which had even influenced Dryden; but his views were afterwards carried out by Gray in his *Progress of Poesy* (1754) and *Bard* (1756), Pindaric odes in a much truer sense than the spurious imitations of Cowley and his followers. Shortly before, in 1747, Collins had published the volume containing his ode *To Evening*, *The Passions*, and other exquisite examples of the Æolian type. The four great poets of the romantic revival—Wordsworth, Coleridge, Shelley, and Keats—all produced odes of the highest beauty, which, in conformity with the teaching of the school, completely set aside all conventional rules. The finest odes by more recent poets are Tennyson's *On the Death of the Duke of Wellington*, Coventry Patmore's *To the Unknown Eros*, and Swinburne's *To Victor Hugo in Exile*.

Oder, THE, a river of Germany, rising in the Odergebirge, Moravia, 14 miles E. of Olmutz, and emptying itself into the Baltic Sea at Swinemünde after a course of 550 miles. Passing with a sharp fall through Moravia, and dividing Prussian from Austrian Silesia, it meanders for 490 miles, through Silesia, Brandenburg, and Pomerania, in a sluggish and shallow stream, till it loses itself in the lagoon known as the Stettiner Haf, thence finding its way to the sea by three channels, of which the Swine is the chief. The principal tributaries are the Oppa, the two Neisses, the Katzbach, and the Bober on the west, and the Malapane, Bartsch, and Warthe on the east. Besides Swinemünde the towns of Ratibor, Oppeln, Brieg, Breslau, Glogau, Frankfort, Custring, and Stettin are on its banks. Navigable for sea-going craft as far as Stettin, it is with some difficulty kept open for barges and river-steamers up to Oderberg, and much traffic passes up and down. Canals connect it with the Havel, the Spree, and other rivers.

Odessa, a port of Russia, at the N.W. corner of the Black Sea, and the fourth city of the empire, stands on the S. shore of a fine, but exposed bay, the shipping finding shelter in three harbours. The existing town dates only from 1791, when Russia definitely took over the place, and to the Duc de Richelieu, an early governor, much of its

advancement is due. It is now the capital of Novorossia, has a fine cathedral (1849), a palace and public park, and an excellent university. The climate, owing to the surrounding lagoons, is unhealthy. The exports are flour, wheat, cattle, hides, tallow, and hemp, whilst colonial products and manufactured goods are largely imported.

Odin, the Scandinavian name for the deity known among Teutonic races as Woden or Wotan. The son of Bestla and Bor, the husband of Freya or Frigga, and the father of Thor and Baldur, he typifies manly virtues, such as courage and wisdom, but not without a mixture of craft. He is often described as one-eyed, riding on an eight-legged horse (Sleipnir). Though supreme among the gods, he is not immortal, and when the Æsir (and, with them, the world) are destroyed, he will perish under the fangs of Fenrir, the wolf, the offspring of Asa-Loki.

Odoacer, or ODOVACAR, the son of a Hun or possibly a Goth, was born about 434 A.D., and entered the imperial service about 464. In 476, having attained high rank, he headed his countrymen in a revolt against the boy Augustulus and became emperor, though recognised only as patrician. Fear of his greatness probably induced Zeno, the Eastern Emperor, to direct against him the Ostrogothic hordes under Theodoric, who defeated him in several battles, besieged him in Ravenna and, under the pretence of a peaceful meeting, murdered him in cold blood (493), and exterminated his family.

Odonata, the order of insects which includes the Dragon-flies (q.v.).

O'Donnell, HENRY JOSEPH, was born in 1769 in Spain, and, entering the army, had attained the rank of general when, in 1810, he received a command in Catalonia. He distinguished himself, and became a field-marshal with the title of count. Ferdinand VII. retained his services. His conduct during the French invasion of 1823 brought him under suspicion, and he fled to Limoges, where he died in 1834. LEOPOLD, his second son, was born at Teneriffe in 1809, and, at the outset of his military career, attached himself to Queen Christina, whom he accompanied in exile. In 1843 he succeeded after several previous attempts in ousting Espartero from power, and was rewarded by the governorship of Cuba. In 1854 he was Minister for War under Espartero, but plotted against him, and in 1856 was for a few months Prime Minister. He returned to power in 1858, headed the Morocco expedition, and was created Duke of Tetuan. From 1863 to 1865 he was out of office; not long after his final success he found himself baffled by Narvaez. He died at Bayonne 1867.

Odontoglossum, a large genus of orchids, mostly natives of cool, elevated localities from Mexico to Venezuela and Peru, many of which are in cultivation. Some are terrestrial, and others epiphytes. Their large and brilliantly-coloured flowers have spreading sepals divided to their bases and nearly equal-sized petals.

Odontopteryx, a fossil bird, described by Sir

Richard Owen, from the London Clay of the Isle of Sheppey, with serrated mandibles, probably a fish-eater, like the Merganser.

Odontornithes, the name proposed by Professor O. C. Marsh for an extinct order of birds, including the remarkable genera *Ichthyornis* and *Hesperornis* (q.v.) from the Cretaceous rocks of Kansas, both of which have true teeth. *Ichthyornis* had powerful wings, a well-developed keel to its breast-bone, biconcave vertebræ, and its teeth in distinct sockets, whilst *Hesperornis* has the merest rudiment of a wing, a flat breast-bone, saddle-shaped vertebræ, and its teeth in a common alveolar groove. Professor A. Newton consequently prefers to break up this proposed order, relegating the former genus to the order Carinatae and the latter to the Ratitæ. [BIRDS.]

Æcolampadius, really JOHN HAUSSCHEIN or HEUSSGEN, the German patronymic being classicalised, was born at Weinsberg, in Würtemberg, in 1482. Trained at Heidelberg, he became a pastor at Basle in 1515, and at once joined the party of reform. In 1518 he was transferred to Augsburg, and was for a while a monk, but four years later went back to Basle, where he openly preached the new doctrine, following Zwingli rather than Luther. He died in 1531. He was the author of a Greek grammar, commentaries on the prophets and Genesis, and a treatise, *De Ritu Paschali*.

Ædema is derived from a Greek word signifying "a swelling," and is applied to the condition in which there is an effusion of serous fluid into the connective tissue spaces beneath the skin; e.g. œdema of the eyelids, or œdema of a limb due to the blocking of a vein. Ædema of the lungs is the condition in which the passages of the lung become choked by the exudation of serous fluid, and *œdema glottidis* is the expression used to designate the effusion of fluid into the tissues beneath the mucous membrane of the glottis, leading to swelling and to obstruction of the passage of air through that aperture. [DROPSY.]

Ædipus, a legendary King of Thebes, son of Laius and Jocasta, was exposed at his birth, owing to a prophecy that he would cause his father's death. Saved by a shepherd, the boy was brought up at the court of Polybus of Corinth in ignorance of his origin. Meeting Laius in a narrow road, he quarrelled with and slew him. Then, solving the riddle of the Sphinx, he married his own mother. When the truth came out, the wretched king put out his eyes, and, wandering into exile under the care of his daughters, died at Colonus. The story is referred to in the *Odyssey*, and was the subject of tragedies by Æschylus and Sophocles.

Æhlenschläger, ADAM GOTTLÖB, was born in 1779 at Copenhagen. The English bombardment in 1801 inspired him to write a dramatic sketch of much power. Later came the fine poem of *Guld-hornene* and a collection of verse that proved a revelation to Danish literature. *Aladdin's Lampe* soon followed, and a grant from the Crown enabled him to visit Weimar, Paris, Switzerland, and Rome, returning to Denmark in 1810 to take the chair of

Æsthetics. During this period he produced *Hakon Jarl*, *Baldur hin Gode*, *Palnatoke*, and *Axel og Valborg*, his greatest dramatic works. *Helge* and *Dina* are the most noticeable of his later works. He died in 1849.

Æneis, a genus of butterflies, belonging to the family *Nymphalidae* (q.v.), and including many Alpine and Arctic species.

Ænothëra, a genus of the calycifloral order Onagraceæ, mostly herbaceous and natives of America. They have crowded radical leaves, scattered cauline ones, large self-coloured flowers opening usually in the evening, a four-cleft, reflexed, deciduous calyx, and numerous seeds. The best-known is the so-called Evening Primrose (*Æ. biennis*), with pale yellow flowers, which often escapes from gardens in England (where it and other species are cultivated), and is naturalised.

Oersted, HANS CHRISTIAN and ANDERS SANDØE, two brothers, born in 1777 and 1778 respectively, and educated at the university of Copenhagen. The elder distinguished himself as a physicist, and in 1819 propounded the identity of electricity, magnetism, and galvanism, a discovery for which he received the Copley medal of the Royal Society and an award from the French Institute. He next engaged in experiments as to the compressibility of water, and a year or two later discovered the metal aluminium. His skill in popularising science led to the publication of his lectures in a volume entitled *The Soul in Nature*. He died in 1851. The younger Oersted adopted the legal profession, which he afterwards combined with politics, becoming in 1853 Prime Minister of Denmark. His reactionary tendencies led to his impeachment, and, though acquitted, he took no further part in public affairs, but died in retirement in 1860.

Oesel, or ESEL, an island stretching across the mouth of the Gulf of Riga, in the Baltic Sea, and included within the Russian province of Livonia. It has an area of 1,010 square miles, being about 45 miles long by 30 miles broad, with a bold limestone coast and an undulating, well-watered, and well-wooded interior. Grain, flax, hemp, potatoes, and timber are the chief products, and the island is famous for a breed of small ponies. Belonging at first to the Teutonic Knights, it was occupied successively by Danes and Swedes, and ceded finally to Russia in 1721. The population is almost entirely Lutheran, and the capital, Arensburg, on the south coast, is little more than a large village.

Æsophagus, or GULLET, connects the lower part of the pharynx with the cardiac orifice of the stomach. It is about 9 inches long, and is lined internally with mucous membrane, beneath which is the submucous tissue containing glands, and external to this a muscular coat. The muscles of the œsophagus by their wave-like contraction convey the bolus of food received from the pharynx into the stomach.

Offa's Dyke, a great entrenchment, 100 miles long, constructed by Offa, King of Mercia, about 780 A.D. Starting at Newmarket, in Flintshire,

near the mouth of the river Dee, it traverses the counties of Flint, Denbigh, Salop, Radnor, Hereford, and Monmouth, ending at Beachley, where the Wye joins the Severn.

Offenbach, JACQUES, was born in 1819, and was sent very early to Paris for education as a musician. In 1848 he made a hit as a composer with a song introduced into Musset's *Le Chandelier*. His first operatic work, *Pepito*, appeared in 1853, and during the next twenty-five years he produced sixty-nine operas. He caught the taste of the Parisian public, and may almost be said to have founded a school. His most popular efforts were *Orphée aux Enfers*, *La Grande Duchesse*, *La Belle Hélène*, *Geneviève de Brabant*. He died in 1880.

Og, King of Bashan, and, with Sihon, of the Amorites, was defeated by the Israelites. He is said to have been of enormous stature, his bed being nine cubits long.

Ogee, a moulding consisting of a round or convex member, followed by a hollow or concave one. An ogee-arch is a pointed arch, the sides of which are two ogees which unite to form the apex. On the other hand, the French *ogive* denotes any kind of pointed arch.

Oglethorpe, JAMES EDWARD, was born in 1696, and at eighteen joined the army of Prince Eugène in the campaign against Turkey. Coming home in 1722, he sat in Parliament, and took a great interest in the relief of distressed insolvents, for whose benefit he founded the colony of Georgia. In 1745 he became implicated in the Jacobite rising, but was acquitted. He retired as a full general, and died at his seat in Essex in 1785.

Ogoway, or OGOWE, THE, a river which rises in a sandy plateau, N. of the basin of the Congo, and about 300 miles from the W. coast of Africa, and not far from the Equator. On approaching the coast, it receives several large affluents, and opens out into a broad stream of 8,000 feet, being connected with the lakes Ajingo and Jonanga. It is then split by a delta, some 80 miles long, into several branches, of which the most northerly, the Nazareth, enters the ocean a little above Cape Lopez, whilst the southern streams are lost in the Cama Lagoon and the Rio Fernao Vas.

Ohio. 1. The third in importance of the United States of North America, is bounded N. by Michigan and Lake Erie, W. by Indiana, E. by Pennsylvania, and E. and S. by the Ohio, having an area of 40,760 square miles, most of which consists of an undulating plain, divided by a watershed running N.E. to S.W. into two unequal districts, the larger drained by the Ohio and the smaller discharging its waters into Lake Erie. The soil produces abundance of wheat, maize, fruit, and even tobacco and wine, supporting also great numbers of oxen and sheep. There still exist many acres of virgin forest, yielding valuable timber. Coal-beds and iron-stone are worked very profitably in the eastern districts. The chief cities are Cincinnati, Cleveland, Columbus (the state capital), Dayton, Toledo, and Zanesville. The railway and canal systems

are highly developed. Education, elementary and advanced, is supported by taxation and endowment. The N.W. district was exempted from slavery as early as 1787. The French were the first settlers about 1671, and ceded their claims in the Treaty of Paris (1763) to Great Britain.

2. A river of North America, formed by the junction of the Alleghany and Monongahela at Pittsburgh, Pennsylvania. From this point it flows W.S.W. for 950 miles, till it joins the Mississippi at Cairo, 193 miles below the confluence of the Missouri. It drains at least 200,000 square miles, receiving in its course the Wyandotte, Muskinquin, Scioto, Miami, Licking, Kentucky, White, Wabash, and Tennessee, besides smaller tributaries. Its steamboat traffic is considerable, its waters are clear, and many important towns stand on its banks.

Ohm's Law. When an electric current is flowing along a wire or other conductor its strength depends partly on the electromotive force which is driving it, and partly on the resistance of the wire. It is found that the strength of the current (C) is equal to the quotient obtained by dividing the electromotive force (E) by the resistance (R) of the wire: $C = \frac{E}{R}$. This is known as Ohm's Law.

Ohnet, GEORGES, was born in Paris in 1848, and received a good education. He was called to the French bar, but, after some years' practice as an advocate, took to journalism, which he presently abandoned for fiction. In 1881 he published *Serge Panine*, the first of a series of novels comprehended under the title of *Les Batailles de la Vie*. The next year appeared *Le Maître de Forges*, followed by *La Comtesse Sarah*, *Lise Fleuron*, *La Grande Marnière*, *Les Dames de la Croix-Morte*, and *Volonté*.

Oidium. [MILDEW.]

Oil-Beetles, a group of small wingless black beetles belonging to the genus *Meloe*, the members of which live on grass, etc. The larvæ attach themselves to bees, who unknowingly carry them into the hive; here they feed on the pollen stored up as food for the larvæ of the bees.

Oil-Bird. [GUACHARO.]

Oil-Cakes consist of the residue of oil seeds from which a large amount of the oil has been extracted. The following is the usual proportion of the ingredients:—

	Linseed-Cake (English).	Rape Cake.	Decorticated Cottonseed Cake.	Poppy Cake.
Water - - -	12	11	9	12
Flesh-forming principles -	28	30	38	32
Oil - - -	10	11	13	6
Gum, mucilage, etc. -	34	30	20	30
Woody fibre - - -	10	10	9	9
Mineral matter (ash) -	6	8	11	11
	100	100	100	100

Linseed-cake is especially used in completing the fattening of oxen. The colour should be reddish-

brown, the appearance uniform, and the taste and smell pleasant; a disagreeable smell and a greyish tint betray adulteration. Rape-cake is not so well flavoured as linseed-cake. Some feeders consider it as nutritive, while others believe it to be very inferior. When free from mustard and of good quality, it is more economical than linseed-cake. Oil-cakes are also used as manures.

Oil-Engines, the term usually applied to those engines in which the oil fulfils one or two functions; it may be used as fuel, or be the working agent itself, being converted into gas in the cylinder, as water is into steam in the steam-engine. An oil both easily obtained and cheap is necessary for success, hence the Priestman Oil-Engine (1888) by using petroleum marked a distinct epoch in the history of heat-engines. Oil-engines are usually small and compact; they require very little hand-labour, and can be started or stopped instantaneously.

Oils. A large number of bodies, varying greatly in their nature, mode of occurrence, and chemical characters, is included under the term *oils*. They are more commonly understood to be more or less viscous, liquid substances, inflammable, and insoluble in water. They are composed chiefly of carbon and hydrogen, with oxygen frequently and sometimes sulphur, etc. Formerly, however, many other liquids of an oily consistency were known as oils which are not now so regarded, e.g. *oil of vitriol*. The name is usually restricted to substances which are liquid at ordinary temperatures, and so distinguished from the *fats*, which are, however, not chemically distinct. Oils may be divided broadly into three classes: the *mineral oils*, the *fixed oils*, and the *essential* or *volatile oils*. The first of these form a class of very inflammable liquids, which are chiefly obtained from borings or wells in the earth, largely at Pennsylvania and Canada. They consist almost entirely of hydrocarbons, and are very largely employed as illuminants, for fuel, and in a number of industrial purposes, e.g. *naphtha*, *petroleum-fuel*. The fixed oils are all more or less closely chemically related to one another, being compounds of different organic acids with glycerine. They exist largely in animal and vegetable organisms, and are obtained from the natural sources. From vegetation the oils are usually extracted by incisions, by pressure of the containing organs with, if necessary, the aid of heat, or by dissolving out the oil by means of a suitable solvent. The chief acids present in these compounds and the fats are *palmitic*, *stearic*, and *oleic*, the two former being in greater quantities in the solid fats than in the liquid oils. Some oils dry and harden if exposed to the air. Such *drying oils* are largely used as media for paints, etc. Other oils do not dry, but remain greasy under the same conditions, and are hence useless for mixing with pigments. Linseed oil, hemp oil, nut oil, poppy oil, are examples of drying oils; while olive oil, almond oil, colza oil, rape oil, castor oil, etc., are non-drying. A number are used medicinally, as croton, castor, cod-liver, almond oils, etc. Very many are used as articles of

diet, while others find employment as illuminants and fuels. They are also extensively used for the manufacture of soaps (q.v.) and candles (q.v.), as lubricants, varnishes, in painting and perfumery, and for many other purposes. The *essential* oils do not exhibit the thick oily feel of the previous class. They are usually colourless or slightly yellow liquids, insoluble in water, and very inflammable. They are obtained chiefly from plants by pressure, maceration, extraction, or by *distillation*. They are usually of the nature of ethereal salts of organic acid, and find application in perfumery, many of them possessing most agreeable odours. Almost all are used in medicine, and many are employed as flavouring materials, as, *e.g.* oils of cloves, nutmeg, carraway, etc.

Ointments are mixtures of various drugs with fatty material, such as as suet, wax, lard, benzoated lard, or oil, and intended for outward application. Such are simple ointment, zinc ointment, various mercury ointments, etc., of the Pharmacopœia.

Oise, a river and department in northern France. The former rises by two streams, one of which has its source near Rocroy in the Ardennes, the other near Chimay, in Belgium. Flowing S.W., past Guise, Chauny, Compiègne, and Pontoise, it joins the Seine near Conflans, after a course of about 150 miles. The department is bounded N. by Somme, S. by Seine-et-Marne and Seine-et-Oise, E. by Aisne, and W. by Eure and Seine-Inférieure. It has an area of 2,260 square miles. The chief products are wheat and other cereals, beet-root, colza, hemp, flax, vegetables, fruit, milk, meat, cider, and wine of poor quality. There are large iron-works at Montataire, lace-works at Chantilly, clock and carpet factories at Beauvais, and woollen mills at various places.

Ojibways. [CHIPPEWAYS.]

Oka. 1. A river in European Russia, which, rising near Orel, flows through the richest districts of central Russia, and joins the Volga at Nijni-Novgorod, after a course of 840 miles. It has a basin of 127,000 square miles.

2. A river of Asiatic Russia, rising on the Chinese frontier and flowing north, through the government of Irkutsk, till it unites with the Angara at Bratskoi. It is from 400 to 500 miles in length, and receives the waters of the Ija from the west.

Okandas, a large nation about the middle course of the Ogoway river, west Equatorial Africa; a tall fine race of Negroid type, but cannibals, as indicated by the custom of filing the teeth to a point. They are everywhere known by the habit of going about with a "walking stick" 5 to 6 feet long, which is never laid aside. The dead are neither buried nor burned, but thrown into the river weighted with a large stone to prevent the body from rising, in which case the head would be taken and converted into a fetish by the neighbouring Aduma and Osyeba tribes. The Okandas are great boasters, like the kindred Mpongwés of the coast districts, and so indolent that they can never be got to work on the French plantations in the Ogoway and Gaboon regions.

Oken, or OEKENFUSS, LORENZ, was born in 1779. He began to study natural science and medicine at Würzburg, but afterwards went to Göttingen, where in 1802 he issued his *Grundriss der Naturphilosophie*. His *Lehrbuch der Naturphilosophie* appeared in 1809-11. He had in the meanwhile been transferred to Jena and then to Munich, and had begun to edit *Isis*, a periodical which gave offence to the authorities. He fell into disfavour, and in 1832 sought refuge in Switzerland, was made professor at Zürich, and died there in 1851.

Oklahoma ("Beautiful Land") is the name given to a territory situated within the Indian Reservations, but returned to the United States by its Indian occupants in 1866. It lies between Texas, Kansas, and Arkansas, and was opened to settlers April, 1889. Guthrie, Oklahoma, and Kingfisher are the chief townships. A bill for its admission as a State was before Congress December, 1893.

Okotas, a widespread people of the Ogoway basin, west Equatorial Africa, who originally occupied the right bank of that river; but about 1870 they were attacked and dispersed in all directions by the fierce Ossyebas (Fans), and are now found in small groups scattered over a vast area, though still most numerous in the islands of the Ogoway about the Njole rapids. The neighbouring Yalibongos (Alimbongos) and the Bakotas, who dwell higher up near the Sébé confluence, appear to be all members of the Okota family, some of whom have also been met with in the forest districts watered by the Ivindo river. Since the destruction of their plantations by the Ossyebas, the Okotas live mainly on roots and fruits, especially the large green dika berry, which is very nutritious, with a taste like cacao.

Olaf, the name of several kings of Denmark, Sweden, or Norway, who reigned at various periods from the 7th to the 14th century. Chief among these was OLAF II., known as St. Olaf, who wrested the Norwegian throne from Eric in 1012 and began to propagate Christianity. His subjects rebelled and called in Knut the Great from Norway, and Olaf, being expelled, fled to his brother-in-law Jaroslav of Russia, who lent him men to recover his throne. In this he failed, for he was killed in 1030 at the battle of Sticklestad. He became the patron saint of Norway, and so lately as 1847 a knightly order was established in his honour.

Old Bailey, the court or sessions-house in which are held the monthly sittings of the Central Criminal Court, established in 1834, for the trial of offences committed in the City of London, the county of Middlesex, and parts of other counties within a certain distance from the Metropolis. The name is properly that of the street itself, which runs from Ludgate Hill to Smithfield, passing Newgate Prison. The judges of the Central Criminal Court are the Lord Mayor, the Sheriffs, the Lord Chancellor, the Judges, the Aldermen, Recorder, Common Sergeant of London, Judge of the Sheriffs' Court, or City Commissioner, and any others whom the Crown may name as assessors. Those who actually preside, however, are the

Recorder and Common Sergeant, a judge of the law attending only when unusual legal questions are raised or the prisoner's life is involved.

Oldcastle, SIR JOHN, LORD COBHAM, was born about 1360. He was entrusted with the command of the army that compelled the Duke of Orleans to raise the siege of Paris in 1411. He had before this adopted the tenets of the Lollards, and soon became their recognised leader. Henry IV. protected him, but Henry V. took action against him. He was imprisoned in the Tower, every effort being used to make him recant. Having escaped, he concealed himself in Wales, and his supporters rose in arms. In 1417 he was captured, brought to London, and burned alive in St. Giles's Fields. He wrote *Twelve Conclusions addressed to the Parliament of England*, and edited Wyclif's works. For the connection with Falstaff, see any good commentary on Shakespeare.

Old Catholics, a religious body which arose in consequence of the dogma of Papal Infallibility promulgated by the Vatican Council of 1870. In Germany, the chief seat of disaffection, the movement was led by Dr. Döllinger, Professor of Theology at Munich, and Professor Friedrich, who were excommunicated by the Archbishop of Munich in April, 1871, owing to their refusal to submit. Those who shared the views of Döllinger and Friedrich called themselves Old Catholics to signify that they held the primitive Catholic faith free from the later doctrines imposed by Papal authority. The first congress was held at Munich in September, 1871, when arrangements were made for organising congregations. An episcopate was obtained from the Jansenist Church of Holland, Dr. Joseph Hubert Reinkens, the first Old Catholic bishop, receiving his orders from the Bishop of Deventer in August, 1873. The alterations in the service-books, which included the translation of the Mass into the vernacular and the omission of the Invocation of Saints, caused many relapses to the Church of Rome. The Reunion Conferences held at Bonn in 1874 and 1875 were attended by divines from Germany, Switzerland, France, America, England, and other countries, but the formulæ of agreement drawn up were rejected by the Eastern Church and the Church of England. The chief source of disunion among the Old Catholics has been the question of the celibacy of the clergy. The number of Old Catholics was in 1887 estimated at 70,000 in Germany, and 80,000 in Switzerland. In the latter country the Bishop Herzog was consecrated by Reinkens in 1876. Old Catholicism has also established itself in every Roman Catholic country except Belgium, though only to a small extent.

Oldenburg, a German grand-duchy, and its capital. The former has an area of 2,480 square miles, and comprises the three detached territories of the duchy of Oldenburg, the principality of Lübeck, and the principality of Birkenfeld. Oldenburg proper makes up about seven-eighths of the whole, and is bounded by the German Ocean to the N., and by Hanover on all other sides, except where it touches Bremen on the E. The alluvial coast district, protected from the sea by dykes, is fertile but

swampy, producing good crops of cereals and rape, whilst inland are vast tracts of heather. Sheep, horses, and cattle are reared in abundance, and the rivers, canals, and railways afford excellent facilities for trade. Oldenburg, the capital, stands on the river Hunte, about 25 miles N.W. of Bremen. The town hall and ducal palace are in the Renaissance style, and the latter contains a fine picture gallery and library. There are few industries, but a large trade is carried on in grain and horses.

Oldham, a parliamentary borough and manufacturing town in Lancashire, 6 miles N.E. of Manchester on the river Medlock. It is an important railway centre, and canals connect it with the neighbouring centres of trade. About a fourth of the cotton products of England are turned out here—fustians, velvets, cords, shirtings, sheetings, nankeens being the chief manufactures. There are good public buildings and a richly-endowed Blue-Coat school. It returns two members to Parliament.

Oldhaven Beds, the name given by Mr. Whitaker in 1866 to a series of pebble-beds and sands, from 20 to 30 feet thick, between the Woolwich beds and the London Clay. The name is taken from Oldhaven Gap, on the north coast of Kent. The pebble-beds are of rolled flints; the sands exhibit current-bedding; and the fossils include some sub-tropical plants and numerous gastropods, partly estuarine and partly marine, some belonging to Woolwich-bed species and others to those of the London Clay. On the whole, there seems little reason for distinguishing the Oldhaven beds from the other local shingle-beds at various levels in the Woolwich series.

Old Lady (*Mormo maura*, Linn.) is one of the commonest of the larger British Noctuæ (q.v.). The colour is dark brown, and the margins of the wings are scalloped.

Old Red Sandstone, a great series of red and grey sandstones, conglomerates and shales, with a maximum thickness of 10,000 feet, the base of which often passes conformably downwards into the Silurian series, whilst its upper part passes similarly into the Carboniferous. It is termed "Old" because thus below the Coal-measures, as distinguished from the New Red Sandstone above them. The conglomerates sometimes contain large angular, possibly ice-borne blocks, and hard micaceous, calcareous, and bituminous flagstones occur in the series. There seems to be generally an unconformity dividing the lower from the upper Old Red Sandstone. Like most sandstones, this system contains few fossils, save in a few localities. Land plants, chiefly ferns and club-mosses, myriapods and palæodictyopterous insects occur; but the most characteristic forms are the crustaceans and fishes. The former are Eurypterida, including the gigantic king-crab *Pterygotus*, sometimes 6 feet long; the latter, ganoids, sometimes reach a large size and are so numerous and varied that the period has been termed the "Age of Fishes." These fish have their nearest living representatives among fresh-water forms, and this, with other facts, suggests that the Old Red Sand-

stone marks the beginning of a great continental period, and was deposited in a series of large fresh-water lakes. In the British Isles, Sir Archibald Geikie has traced five of these lakes in the British Isles—(1) the Welsh Lake, mainly in Herefordshire; (2) Lake Cheviot; (3) Lake Caledonia, extending from the north of Ireland through the central valley of Scotland; (4) Lake Lorne, in Argyshire, and (5) Lake Orcadie, extending from Elgin, through Caithness and the Orkneys, to the Shetlands. This phase of sedimentation is hardly represented on the Continent; but the Gaspé Sandstones of New Brunswick and Nova Scotia are similar. Contemporaneous volcanic rocks, felsites, tuffs and diabases, having a total thickness of 6,000 feet, form the Pentland, Ochil, and Sidlaw Hills. The Lower Red Sandstone, including the Arbroath flags and valuable Caithness flags, and probably represented by the Glengarriff grits in south-west Ireland, yield *Lepidodendron* (q.v.), *Calamites* (q.v.), *Sigillaria* (q.v.), *Pterygotus*, and such fish as *Pteraspis*, *Cephalaspis* and *Asterolepis*. The Upper Old Red Sandstone includes the Dura Den beds in Fifeshire, crowded with *Holoptychius* and other fish, and the Kiltorcan beds in Kilkenny, in which the fern *Palæopteris* and the fresh-water mussel *Anodon* were found. The Old Red Sandstone forms the fertile lands of the Carse of Gowrie and of the orchards and hop-fields of Herefordshire. [DEVONIAN.]

Oleander (*Nerium Oleander*), "a small shrub of a gallant shewe," as Gerard terms it, is a member of the periwinkle family (*Apocynaceæ*), native to the Mediterranean region, but long cultivated in English greenhouses for its pretty rose-coloured or white flowers. It has a very poisonous milky juice. There is a ring of fringed scales in the throat of the corolla-tube; the five anthers are hairy, and each of the numerous seeds is also crowned with a tuft of hairs. The leaves are leathery, opposite, lanceolate, and olive-tinted, whence it derives its name.

Olefiant Gas. [ETHYLENE.]

Olefines are a series of hydrocarbons represented by the general formula C_nH_{2n} . They possess the power of directly uniting with chlorine, bromine, etc., with hydrochloric and allied acids to form compounds, such as $C_2H_4Cl_2$, C_3H_7Cl , etc. They are hence called *unsaturated* compounds. By the action of nascent hydrogen they may be converted into saturated compounds which cannot unite directly in this manner with chlorine—the *paraffins*. Many of them are produced by the destructive distillation of carbonaceous substances, and hence occur largely in ordinary coal gas, tars, etc. The first member of the series possesses the formula C_2H_4 , and is known as *ethylene* (q.v.), which is a gas at very low temperatures. The higher members are solid, while the intermediate compounds remain in the liquid state under ordinary conditions.

Oleic Acid is an acid of the composition $C_{18}H_{34}O_2$ which occurs very largely in most fats and oils, e.g. butter, lard, olive oil, etc, especially in the non-drying oils. In these sources it exists in combination with glycerine, from which it may

be separated by treatment with superheated steam, or with (1) an alkali followed by (2) an acid. It is an oily liquid, colourless if pure, which decomposes on distillation, but may be distilled by high-pressure steam. It has a specific gravity of about .9, and may be obtained crystalline at low temperatures. An impure acid is largely used as a lubricant under the name of olein or wood oil. Many of its salts, e.g. those of lead, mercury, zinc, and morphine, are used in pharmacy, chiefly for the preparation for ointments. Sodium and potassium oleates are the chief constituents of hard and soft soap respectively. Other allied acids of the same general characters are also known under the general name of oleic acids.

Olein. Oleins are the compounds of oleic acid with glycerine, being termed tri, di, or mon-olein, according to the number of HO-groups of the glycerine replaced by the acid group. The name is also given to a crude oleic acid used as a lubricant.

Oléron, an island off the S.W. coast of France, separated from the mainland by the Passe de Maumusson, and opposite the mouth of the river Charente. It is 20 miles long and about 5 miles broad, with an area of 59 square miles. The soil is very fertile, and supports a large population, mostly Protestant. Ship-building is carried on here, and there are large salt-works. The two principal towns are Château d'Oléron on the S.E. coast, and St. Pierre d'Oléron in the centre. A famous code of maritime law took its name and origin hence.

Olibanum. [FRANKINCENSE.]

Oligarchy (Greek, "rule of a few") as used by Plato and Aristotle denotes the rule of a small exclusive class, who make use of their power only to promote their own interests. Oligarchy is the corrupted form corresponding to *aristocracy*, "rule of the best." [GOVERNMENT.] Most of the mediæval Italian towns afforded at some period of their history typical examples of oligarchies.

Oligocene System, a series of Tertiary rocks classed by Lyell as Upper Eocene, but separated by Professor Beyrich, and named from their containing a few species of Mollusca which are still living. In Britain it is perhaps solely represented by beds, formerly known as the Upper Fluvio-marine series, in the north of the Isle of Wight and in the New Forest. They are thin-bedded marine, brackish, and fresh-water sands; clays, marls, and limestones, and subdivided as follows:—

HEMPSTEAD BEDS.—Marls, about 160 feet thick, with a marine clay above, but mostly fresh-water and estuarine, containing *Viviparus lentus*, *Melania*, *Cyrena*, *Unio*, cypriids, and gyrogonites.

BEMBRIDGE BEDS.—Estuarine marl (62 feet) above, with *Ostrea rectensis*, and fresh-water limestone (20 feet), with *Limnaea longiscata*, below.

OSBORNE, ST. HELENS AND BROCKENHURST BEDS.—About 70 feet thick, fresh-water, with the *Nettlestone Grit*, a building-stone.

HEADON BEDS.—Clays and limestones, 180 feet thick, fresh-water above and below, marine in the middle.

In Switzerland, 6,000 feet of lacustrine sandstones, marls, and conglomerates, known as *nagelfluh*, or *molasse*, and now elevated into the Rigi and Ross-

berg, were deposited during this period, as were also the lignites of the Lower Rhine and the amber-containing glauconitic sands of Königsberg. The eruptions of Antrim, Mull, Skye, the Faroes and Greenland were probably continued from the previous Eocene period, those in Auvergne and the Eifel being somewhat later, and this and the succeeding Miocene epoch were probably the period when the Alps and Pyrenees were uplifted, and the great east and west folds of Cretaceous and Eocene rocks were produced that formed the Vienna, Paris, Artois, Hampshire, and London basins, the monoclinical fold of Dorset and Wight, and the anticlinal of the Weald. *Palæotherium* (q.v.) and other tapiroid forms occur in rocks of this period, especially in the gypsum beds of Montmartre near Paris, giving place higher in the series to *Rhinoceros*. Carnivora also occur, but still exhibit marsupial characters.

Oligochæta, an order of worms, including all those which have either few or none of the hair-like lateral appendages known as setæ. The common earth-worm (*Lumbricus terrestris*) is the best known member. This order is the second in size of the class CHÆTOPODA or setæ-bearing worms; the other orders are the Polychæta (q.v.), and two less important but interesting orders—the Chætopoda ectoparasitica, and the Archi-Chætopoda. The points which separate the Oligochæta from the Polychæta are as follows:—As regards their structure, the members of the former order have neither feelers (antennæ), lateral processes forming legs (parapodia), certain tactile appendages above and below the parapodia, known as cirri, nor gills (branchiæ); setæ are never numerous, and are sometimes absent, as in the genus *Anachæta*; the animals are hermaphrodite, i.e. both male and female organs of generation occur in the same individual. As regards their development, the ovæ or eggs are laid in small masses in cocoons, and they do not undergo the striking changes in shape of a metamorphism (q.v.). They differ, moreover, in their mode of life, as, though often aquatic, they are never marine, and are generally terrestrial. The order includes many different families; the best known members are the common earthworms (*Lumbricidæ*), the Red-River-worms or *Tubificidæ*, the *Naidinidæ*, including the small lacustrine *Nais* and the *Discodrilidæ*, comprising only *Branchiobdella*, which is a parasite on the lobster, and may be a leech (Hirudinea), and the Aphanoneura, including the remarkable genus *Ælosoma*.

Oligoclase, a plagioclase felspar, having a specific gravity between 2.6 and 2.66, a silica percentage of about 63, and more soda than lime. According to Tschermak's theory, it consists of from two to six molecules of albite mixed with one of anorthite. It is light-coloured, slightly translucent and slightly fusible. It accompanies orthoclase in many granites and trachytes, and occurs also in porphyrites and andesites. From its composition it is sometimes termed *soda-lime felspar*.

Oliphant, LAWRENCE, was born in 1829, and educated for the bar. He published *A Journey to Khatmandu* in 1852, *The Russian Shores of the Black Sea* in 1853, and other works of travel. He

accompanied Lord Elgin to China in 1857, and held for a time the post of *chargé d'affaires* at Peking. On his return to Europe he became *Times* correspondent in Paris, and from 1865 to 1868 sat in Parliament for the Stirling boroughs. Soon after this he published a novel, *Piccadilly*, which was followed up after a long interval by *Altiora Peto*. Meanwhile mysticism attracted him, and he went off with his wife to join a religious community established in America under the auspices of a teacher named Harris. He lost most of his fortune in this enterprise, and, quitting America, settled down on Mount Carmel, occasionally revisiting the civilised world. *The Land of Gilead*, *Sympneumata*, and *Scientific Religion* give some notion of his life at this period, and of the evolution of his views. He died in 1888.

Oliphant, MRS. MARGARET, was born in 1828. Her first attempt at fiction, *Passages in the Life of Mrs. Margaret Maitland of Sunnyside*, was published in 1849, and at once attracted favourable notice. It was followed by a long series of novels. It will suffice to mention the *Chronicles of Carlingford*, *Salem Chapel*, *The Minister's Wife*, and *Within the Precincts*. Mrs. Oliphant has been also an industrious compiler of memoirs, such as *The Makers of Florence*, *The Life of Edward Irving*, and biographical sketches of Montalembert, St. Francis of Assisi, Molière, and Cervantes.

Olivares, GASPARO DE GUZMAN, COUNT DUKE OF, was born in 1587 at Rome. He was educated at Salamanca, and early taken into the service of the future king, Philip IV., who made him Prime Minister. For five-and-twenty years Olivares held almost absolute power, and used it in a vain attempt to restore the military and political prestige of Spain. Catalonia revolted, Portugal asserted her independence, and in 1643 Olivares was banished to Toro, where he died in 1645.

Olive (*Olea europæa*), the best known and most valuable of a genus of about thirty species of small trees with very hard wood, which forms the type of the order Oleaceæ to which the ash, privet, and lilac belong. It is probably a native of Syria, and the cultivation of it though not familiar to the writer of the *Iliad*, is mentioned in the *Odyssey*. In Greece first grown on the limestone hills of Attica, Italy probably received it from Greece; Gaul, Spain, and possibly Britain, from the Romans; Chili from Spain; Mexico and California, from Jesuit missionaries; and China, Australia and Cape Colony, from still more modern enterprise. It is almost hardy in the south of England, flowering and occasionally fruiting, but not ripening. It is a small tree, seldom more than 30 feet high, of slow growth, but sometimes exceeding 20 feet in girth and seven centuries in age. The wild olive or *oleaster* (var. *sylvestris*) has squarish, spinous branches; opposite evergreen, leathery, shortly-stalked leaves, hoary on their under surface; axillary, erect racemes of small white flowers; and small valueless fruit. The calyx and corolla are both four-cleft: there are two exerted stamens, and the ovary is two-chambered and two-styled, each chamber containing one pendulous ovule,

though the stony endocarp of the double drupe generally contains but one seed. The cultivated olive (var. *sativa*) differs in its rounder branches which have no spines, longer leaves, larger fruit, and thicker and more fleshy pericarp. For pickling, the fruits are gathered unripe, soaked in an alkaline lye, and then bottled in brine. For oil, the ripe fruit, the pericarp of which usually yields 60 to 70 per cent., is squeezed, yielding *virgin oil*, and the marc or cake is wetted and re-pressed, and the kernels crushed and boiled to yield a second and third quality. The tree grows best on light or calcareous soils near the sea, and the value attached to its oil as an article of food in countries where butter can with difficulty be preserved made the tree from early times the symbol of peace and good-will.

Olives, THE MOUNT OF, or MOUNT OLIVET (Mod. Jebel el-Tûr), a hill facing the eastern side of the Temple in Jerusalem, and separated therefrom by the brook Kidron. Here Christ delivered his Sermon on the Mount, and hence, according to an unsupported tradition, the Ascension took place.

Olivine, a mineral consisting of a variable mixture of magnesium and iron silicates, Mg_2SiO_4 and Fe_2SiO_4 , crystallising in the Prismatic system, but often occurring in irregular grains, transparent when unaltered, varying in colour from olive-green to yellow, with glassy lustre, conchoidal fracture, specific gravity between 3.2 and 3.5, and hardness between 6.5 and 7. Olivine is an essential constituent of basalt, occurs in some gabbros, and is the main constituent of the peridotites. A pale yellowish-green transparent variety, found in the Levant, is known as *chrysolite* and a leek-green one as *peridot*. These are cut as gems. Olivine is often flawed, and is very liable to alteration by percolating waters or weathering, a change into opaque serpentine, or into limonite, spreading along the flaws, until the whole crystal may be changed.

Ollivier, ÉMILE, born at Marseilles in 1825, was called to the Paris bar, and joined the revolutionary party in 1848, when he obtained an official position under the Republic. In 1857 he entered the Chamber, and won high reputation as an independent and able politician. In 1866 M. Ollivier broke with the Left, and formulated a policy whereby all moderate men should be united under a progressive and conciliatory Imperial programme. To attempt the realisation of this dream he was admitted to office at the critical period of 1870. The fatal issue of the battle of Wörth hurled the Ollivier Cabinet from power. He himself retired for a couple of years into Italy, but returned in 1872, and has since devoted himself exclusively to literature. He is the author of several legal text-books and sundry political volumes.

Olmütz, the former capital of the province of Moravia, Austria-Hungary, is about 130 miles N.E. of Vienna. It is a strong fortress and the seat of an archbishop, and has a large theological university. The cathedral dates from the 14th century. St. Maurice's church (15th century) is celebrated for its organ, and the town hall for its lofty steeple.

Olonellus, a genus of Trilobites (q.v.), which has

recently come into prominence, owing to its being characteristic of the lowest Cambrian strata; it is very like *Paradoxides*, a genus much better known.

Olympia, a valley in Elis, Greece, where the Olympian Games were held every fifth year from the year 776 B.C., or even perhaps earlier. At Olympia were the Olympieion, or temple of Olympian Zeus, containing a colossal statue of Zeus by Pheidias; the Heræon, dedicated to Hera, where a table stood on which the garlands of the victors were laid; the Pelopeion, the Metrōon, the temple of Aphrodite, and the treasury, where dedicatory offerings were stored. During the excavations conducted by the German Government between 1875 and 1881 the Hermes of Praxiteles and several other treasures of art were found.

Olympiad, in the ancient Greek calendar, was a period of four years, the interval which elapsed between two celebrations of the Olympic Games.

Olympias, mother of Alexander the Great. Became the wife of Philip II. of Macedon, but, having been divorced by him, probably instigated his assassination and procured the murder of her rival Cleopatra and her daughter. She also succeeded in dethroning Alexander's successor, but was subsequently captured and put to death by Cassander, son of Antipater, and other generals of Alexander.

Olympic Games. [OLYMPIA.]

Olympus, a chain of mountains between Thessaly and Macedonia. Its topmost peak, upwards of 9,000 feet high, was sacred to the Greeks as the abode of the gods. Pine-forests clothe its summit; its sea-front is broken by vast precipices.

Om, a Sanskrit word of unknown origin, round which (both in the Hindu religion and in Buddhism) gathered associations of a sacred but somewhat vague character. At first it was an emphatic mark of assent; at a later period it symbolised the Hindu trinity, and it has been common to utter the mysterious syllable on various solemn occasions.

Omaguas, South American aborigines on the left bank of the Marañon (Upper Amazons), within Peruvian territory as far as the Itaya confluence north of the Cocomá and Iquito tribes. Although half-civilised, the Omaguas still retain the formerly widespread custom of artificially modifying the shape of the skull by compressing it during infancy between wooden boards. The Omaguas are descendants of the historical Anahuacas, who during the first period of the Spanish conquest were reported to be a rich nation with a great and wealthy capital, residence of the fabled *El Dorado* ("The Golden One"). At present they are disappearing, and very few full-blood Omaguas are now met with; the half-breeds are distinguished by round flabby features, with a heavy inanimate expression.

Omaha, the capital of Nebraska, United States, America, stands on the right bank of the Missouri, at the junction of four railways. Founded in 1854, the town has many fine buildings and all modern improvements. Silver-smelting is the chief industry; but pork-packing and the manufacture of boilers and linseed oil are largely carried on.

Omahas, North American aborigines, a branch of the Siouan (Dakota) family, whose domain formerly comprised the lower course of the Platte River and most of the Elkhorn Valley, in the present State of Nebraska, United States. But, according to the national traditions, they came originally from the district now occupied by the city of St. Louis, and this confirms the view that the Siouan migrations were from east to west, not west to east, as is commonly supposed. The Omahas were not members of the Dakota Alliance, against which they were often at war. Since 1845 most of them have been confined to the Omaha and Winnebago Agency, Nebraska, where they have taken to agriculture, abandoning most of their old pagan usages, and where they have increased from 1,076 in 1875 to 1,158 in 1890.

Omar Khayyám (OMAR THE TENTMAKER), was born near Nishapur, and was contemporary with Nizam-ul-mulk and Hasan ibn Sabah, founder of the Assassins. When the latter became vizier to Sultan Alp-Arslan he provided for his friends, giving Omar an annual pension. Omar became an eager student of astronomy and mathematics, wrote a treatise on algebra, and at the invitation of the Sultan Malikshah introduced a new calendar, the Jalálí, or Seljuk era, which began from March 15, 1079. He is now, however, chiefly remembered as a poet, owing to the translation and amplification of his *Rubaiyat* (quatrains) by Fitzgerald. Omar died about 1123.

Omar Pasha (MICHAEL LATTAS) was born in Croatia about 1810. He escaped from the military school at Thurn to Bosnia, where he became a Mohammedan. When his pupil Abdul-Medjid became Sultan of Turkey he was given high rank in the army, and in 1842 was named governor of Lebanon. Next year he rendered important service by putting down an insurrection in Albania, and in 1853 successfully defended Wallachia against the Russians, whom he also repulsed in 1855 at Eupatoria in the Crimea, where he was Turkish Commander-in-Chief. His last services were in Bosnia and Montenegro in 1861-62, and he died in 1871.

Omen, among the ancient Romans, signified a token of good or ill fortune. The belief in omens is very widespread, and traces of it are continually met with.

Omentum. [PERITONEUM.]

Omnibus (Lat. "for all"), a long, four-wheeled public conveyance for passengers, with the seats arranged opposite one to another between the box in front and the door at the rear. Omnibuses were first used in Paris in the year 1828. In the following year they were introduced into London by Mr. John Shillibeer, the first pair starting from the "Yorkshire Stingo" Marylebone Road, on July 4, 1829. They were drawn by three horses abreast, and ran between the "Yorkshire Stingo" and the Bank, carrying twenty-two passengers (all inside); the fare was a shilling, or sixpence for half the distance, including the use of a newspaper. In 1849 the number of inside passengers was reduced to twelve, provision being made for two on the outside. The

"knife-board," a double bench running down the centre, with a common back for the seats on each side, was introduced in 1857. Its place is now gradually being taken by rows of seats facing the same way as the driver. Omnibuses are now common in the larger towns of Great Britain. They were introduced into New York soon after their first appearance in London.

Omsk, capital of the province of Akmolinsk in Siberia, is situated at the junction of the Om and the Irtysh. The trade is declining, and the place has lost much of its importance as a military station; it is the seat of government of the Russian provinces in Western Asia, and has two cathedrals.

Onager. [DZIGGETAI.]

Onega, a lake in Russia, lying to the north-east of Ladoga, has an area of 3,764 square miles. The river Swir flows from it into Lake Ladoga, and many streams enter it. It is very deep in some places, and is covered with ice for more than a third of the year. Onega is full of fish, and is the scene of a busy trade. A canal has recently been made connecting it with the White Sea.

Oneidas, one of the original "Five Nations" of the Iroquois Confederacy (q.v.), whose territory lay to the south-east of lakes Erie and Ontario, in the present States of Pennsylvania and New York, where the name still survives in Lake Oneida and some other local geographical terms. The nation itself still numbered 3,129 in 1890, all confined to reservations partly in Canada (Thames River and Grand River Reserves), partly in New York and Wisconsin (Green Bay Agency), besides about 100 at Carlisle and Hampton Schools, Pennsylvania and Virginia. The increase has been considerable since 1782, when they had been reduced to 300 during the revolutionary war, in which they sided with the British.

Onion (*Allium Cepa*), a vegetable belonging, like garlic, leeks, and shallots, to a liliaceous genus. It has large, hollow, rush-like leaves; a globose umbel of greenish-white, hexamorous, polysymmetric flowers with a membranous spathe; and a tunicate bulb. The pungent smell and taste are due to a small quantity of a volatile oil containing a large proportion of sulphur. The onion is probably a native of south-west Asia from the Punjab to Palestine, and has been valued as an article of food from ancient Egyptian and Homeric times. Its name, derived from the Latin *unio* (a pearl), through the French *oignon*, alludes probably to the bulb growing singly, unlike the cloves of the garlic (q.v.). When less than 6 inches high, the whole plant is eaten as salad; small bulbs are pickled in vinegar; larger ones are boiled, stewed, or fried, or when scorched are used as colouring for soups. We grow about 40,000 tons of onions annually, and import nearly 4 million bushels. Those grown in Spain and Portugal are larger and milder than English ones.

Onondagas, one of the Iroquois "Five Nations," who occupied a considerable territory south of Lake Ontario, about Lake Onondaga (named from them), in the State of New York.

In 1890 they still numbered 890, some in Grand River Reserve, Ontario, some in the Onondaga, Allegany, Cattaraugus, Tuscarora and Tonawanda Reserves, New York.

Ontario, the western part of Canada proper, has an area of 181,800 square miles. It is fringed by lakes on the south and west. A chain of hills extends from near Kingston to the shores of Georgian Bay, opening into Lake Huron; elsewhere the surface is gently undulating. The chief rivers are the Ottawa, which divides the province from Quebec, and the St. Lawrence, whose upper course separates Ontario from New York State. Lake St. Clair lies between it and Michigan; and among inland lakes the chief are Lakes Simcoe, Muskoka, Nipissing, and Tamagouingue. Both agriculture and manufactures are in a flourishing condition. All varieties of grain are grown, as well as fruit and vegetables; and cattle are reared and pastured. Iron, copper, lead, and building stone abound, as also marble, gypsum, and other minerals; while gold and silver are obtained in the north-west. There are very prolific petroleum wells in the south-west, salt wells on the shores of Lake Huron, and immense deposits of nickel at Sudbury. Water-power is largely used for manufactures, which include railway stock and implements, cotton and woollen goods, iron and hardware, paper, and agricultural tools and machines. Internal communication is well provided for by more than 5,000 miles of railway, an extensive canal system, and the lakes. The schools under the Minister of Education are supported by a property tax, and are free to all. Protestant Dissenters, especially Methodists, form the bulk of the population. Toronto is the largest town, the only others of any size being Hamilton and London. Ottawa, in the north-east, is the seat of the Dominion Government. The municipal system is highly organised. Ontario is administered by a Lieutenant-Governor, assisted by an executive council of five, and a Legislative Assembly elected every four years. The province is represented in the Dominion Parliament by 24 members of the Senate and 92 in the House of Commons.

Ontario, LAKE, lies between Canada and New York State, having the river Niagara and its falls at its western end, and the St. Lawrence as its eastern outflow. In area it is 7,240 square miles, being the smallest of the group of great North American lakes; and its mean depth is about 300 feet. It is never frozen except near the shores, which are, generally speaking, flat and uninteresting. Navigation is dangerous, owing to the prevalence of violent storms. The chief ports are Hamilton, Toronto, Port Hope, Coburg, and Kingston, near which the scenery is beautiful. Lake Ontario is connected with Erie by the Welland canal, and with Hudson river by the Oswego canal.

Onychophora. [PROTRACHEATA.]

Onychoteuthis, one of the best-known genera of calamaries or squids. It belongs to the family *Teuthidae*. It includes several species common in

the north Atlantic, where they are sometimes found very far from land.

Onyx, from a Greek word meaning a fingernail, referring to the contrasting bands of colour, is the name of that variety of agate in which the variously-coloured layers are evenly parallel and alternate white or grey with black. If one layer is brown *sard* or red *carnelian*, the stone is termed a *sardonyx*. Oriental onyx has long been exported from Broach and Cambay. The stone was until recently obtained from the Galgenberg, at Idar, in Rhenish Prussia, where it is still cut, polished, and artificially heightened in colour, though the raw material now comes from Uruguay. Onyx is chiefly employed for cameos and intaglios, as brooches, rings, etc. In ancient times banded varieties of stalagnite (q.v.), now known as *onyx-marble*, were also termed onyx.

Oolachan. [CANDLE-FISH.]

Oolite, or ROE-STONE, a limestone made up of rounded concentric grains resembling the roe of a fish, each grain being formed round a minute grain of sand, fragment of coral, shell, or other body. It would seem to have originated in lagoons or enclosed areas of sea, where the water could become concentrated and gentle currents keep the grains in motion. Some Carboniferous limestone is oolitic; but those of our English Jurassic (q.v.) rocks are so markedly so as to be often termed the *Oolites*. Bath-stone is very typically oolitic. When the grains are as large as peas, the rock is called a *pisolite* or *pea-grit*, which is much less common.

Oophore, or OOPHYTE, the stage in the life-cycle of one of the higher plants that bears the sexual organs. Thus, in mosses, ferns, and flowering plants, which are grouped together as *Archegoniatae*, because they have the oosphere enclosed in an archegonium (q.v.), there is a more or less distinct alternation of generations (q.v.), the sexual oophore and the asexual sporophore (q.v.). In mosses (q.v.) the oophore stage is the conspicuous leafy plant; in ferns and their allies [PTERIDOPHYTES] it is the small and generally transient prothallium (q.v.), and in flowering plants [PHANEROGAMIA] it is further reduced to the archisperm and the "included cells" of the pollen-grain, mere parts of the female and male spores.

Oosphere. [OOSPHERE.]

Oospore, the fertilised oosphere or germ-cell, differing in most groups of plants from the unfertilised condition in the possession of a distinct cell-wall. The term is specially employed with reference to those Thallophytes (q.v.) in which the germ cell is dissimilar to the sperm cell (being larger), but is not surrounded by a complex envelope or carpogonium. Thallophytes of this grade, including such algal forms as *Vaucheria* and *Fucus* and such Fungi as *Saprolegnia* and *Peronospora*, were classed together by Sachs as *Oosporae*.

Opah (*Lampris luna*), a large deep-sea fish from the North Sea and the Atlantic, constituting a genus of the Acanthopterygian family Coryphænidae.

The body is deep and compressed from side to side; the tail deeply forked; and the pectorals, ventrals, and the forepart of the dorsal fin falci-form. It attains a length of 4 feet, and is brilliantly coloured. The back is bluish-green, the sides violet blending into the red of the under surface, round silvery spots are scattered over the body, and the fins and tail are scarlet. The flesh is reddish, and is said to be excellent in flavour. It is sometimes called the sun-fish (q.v.), and has other local names.

Opal, the hydrous form of silica, containing from 3 to 13 per cent. of water. It is amorphous, having apparently consolidated from a gelatinous state, and, from the unequal strains induced in this consolidation, behaves with reference to polarised light like a doubly-refracting crystal. Its hardness is 5.5—6.5, and its specific gravity 1.9—2.3. It may be opaque or subtranslucent, one of the latter varieties, *precious* or *noble opal*, exhibiting a beautiful play of iridescent colours. These are explained as due to interference produced by thin included films. It occurs, in veins in trachyte, in Hungary and Honduras; and in ironstone nodules in Queensland; and is a valuable gem. *Hyalite* is a transparent, colourless variety; *fire-opal*, a transparent, red, or yellow one; *common opal* gives no play of colour; and *menilite* or *liver-opal*, from Menilmontant, near Paris, is opaque and brown or grey. Of the less translucent varieties or *semi-opal*, the most interesting are *wood-opal*, replacing particle for particle the tissues of fossil plants, and *geyserite* or *siliceous sinter*, deposited by the heated waters of geysers.

Opatas (ONAVAS), a Mexican people, formerly very numerous and powerful in the state of Sonora, where they reached as far as the crests of the western Sierra Madre, being here conterminous with the Tarahumaras. They comprised four main groups:—(1) The *Tehues*, in the Cucurpe, Sonora, and Matape river valleys; (2) the *Tehuimas*, mainly in the Sonora valley and about the headwaters of the Rio Grande; (3) the *Caguinaehis*, "Highlanders," in the Saguaripa spurs of the Sierra Madre; (4) the *Joras*, between 2 and 3. At present all are settled in pueblos (rural villages); hence they are called "Pueblo Indians" to distinguish them from the neighbouring nomad wild tribes. But they are entirely distinct from the true Pueblo Indians of Arizona and New Mexico, and in appearance resemble the Aztecs and other Nahuas, being short, thick-set, with flat oval features and dark brown colour. But the language shows Pima affinities, the two forming the so-called Opata-Pima family, extending far into the state of Durango. In the wars of the conquest the Opatas were conspicuous for their stubborn resistance to the Spaniards, and in more recent times they were chiefly instrumental in breaking the power of the fierce Apache nomads. Now they are peaceful agriculturists, gradually merging in the half-caste Mexican population.

Opera (Italian *Opera*, abbreviated from *Opera in musica*, "musical work"), a drama which is acted and sung to the accompaniment of a full

orchestra. It was the outcome of the efforts made at Florence towards the close of the 16th century to revive the musical declamation of ancient Greek tragedy. The first genuine Italian opera performed in public was *Luridice* (1600). The success in recitative (*stilo rappresentativo*) which marked this opera, the joint production of Peri and Caccini, was even more conspicuous in the *Orfeo* (1608) and other works of the Mantuan Monteverde, who also enlarged and improved the orchestra. Cavalli relieved the monotony of perpetual recitative by a free use of rhythmic melody, and Scarlatti still further elaborated the use of the aria. Somewhat earlier than this, a native form of opera had taken root in France. Its founder was Lulli (q.v.), who devised a style of recitative eminently adapted to the best French poetry, and at the same time gave a new and richer character to the overture. The English opera, which originated in the masque, enjoyed a short period of vitality during the brief career of Henry Purcell. The Italian opera was introduced into Germany in 1627, and maintained its ascendancy till 1678, when Theile's *singspiel*, *Adam und Eva*, was performed at Hamburg. But the true originator of the German opera was Keiser, who between 1694 and 1734 composed about 120 pieces for the Hamburg Opera House. The English career of Handel, the bent of whose genius drew him to the Italian school, opens with the representation of *Rinaldo* at the Haymarket in 1711. He was the only composer of the period who succeeded in overcoming the difficulties caused by the formal restrictions which prevailed as to the distribution of voices and order of parts. Contemporary with Handel were Hasse and Fux, who maintained Italian traditions at Dresden and Vienna. In Italy, meanwhile, the intermezzo between the scenes of the Opera Seria had grown into the Opera Buffa or comic opera, and the two now advanced side by side. The concerted finale of the latter was afterwards adopted in the Opera Seria also, thus giving rise to trios, quartets, and various rich and dignified *pezzi concertati*. A new era opens with the revolutionary activity of Gluck (q.v.), who in the latter part of his career endeavoured to remodel the lyrical drama in accordance with its proper functions, subordinating music to dramatic action and abolishing the stereotyped form of aria. He met with some success in Paris, where his *Iphigénie en Aulide* appeared in 1774, but eventually his canons had more influence on German than on French opera. To Cimarosa (1754–1801) Italian opera, both of the serious and comic kind, owed more than to any of his countrymen, but he was far outstripped by Mozart, whose *Idomeneo*, *Nozze di Figaro*, and *Don Giovanni* hold the same rank among Italian compositions that belongs to *Die Zauberflöte* (1791) among those of Germany. Beethoven's *Fidelio* (1805), a work of a more serious cast than those of Mozart, is unique and unrivalled in its own sphere. The Romantic element, so much in vogue in the early years of the 19th century, was introduced into German opera by Weber (1786–1826) and Spohr (1784–1859). The greatest composer of the Italian school in the 19th century was Rossini (1792–1868), who has been followed by

Bellini (1802-35), Donizetti (1798-1848), and Verdi (b.1814); the last-named, however, has also shown himself a master of the later developments of opera. At Paris Gluck was succeeded by Cherubini, Spontini, Rossini, Halévy, and Meyerbeer, whose three great operas, *Robert le Diable*, *Les Huguenots*, and *Le Prophète*, appeared between 1831 and 1843. The last great name in the roll of opera-composers is that of Wagner (1813-83). He himself, however, rejected the title, which he regarded as associated with an undue prominence of the musical element. The ideal drama should, according to him, be the joint product of poetry, music, scenery, and action, and none of these factors can be sacrificed to the others without an injurious effect on the common result. This is the great idea which underlies the "music dramas"—*Tristan und Isolde* (1865), *Die Meistersinger von Nürnberg* (1868), *Der Ring des Nibelungen* (1876), and *Parsifal* (1882). Wagner's influence is still paramount, and his theories are likely to lead to new developments in operatic composition.

Opera-Glass (Galileo's telescope) is a form of telescope, but, as its name implies, is chiefly used to render objects or persons on the stage of a theatre more distinct. It consists of an achromatic object-glass, which would naturally form a real inverted image of the object. The rays are, however, intercepted by the eye-piece before they can form that image, and the eyepiece being a concave achromatic lens forms a magnified erect image of the object which the observer sees. The special utility of the instrument is that it gives at once an erect image without any contrivance for reinversion, and its length is so small that it is easy to hold and control.

Operculata, a group of land shells which are distinguished by the possession of a hard plate, which closes the mouth of the shell, similar to that of many marine gastropoda (q.v.), such as the periwinkle (*Littorina littorea*). The only English species is *Cyclostoma elegans*, which is common in limestone districts in the south of England.

Operculum, the name of the calcareous or horny plate used to close the mouth of the shell of the mollusca of the group Operculata (q.v.).

Opicalcite, a crystalline limestone containing spots, veins, or interlaminae of serpentine, as in the so-called "serpentine-marble" of Ballynahinch and the "Eozoon" (q.v.) limestone of the Archæan rocks of Canada. Its exact mode of origin is obscure, the alteration of a magnesian limestone containing silica, and that of a limestone interpenetrated by contact-action with magnesian lava, having both been suggested.

Ophicleide, a bass wind-instrument of metal, developed from the old wooden Serpent (q.v.) towards the close of the 18th century. It has a tube of conical bore with a bell resembling that of a horn, a cup mouth-piece, and (commonly) eleven keys, which control vents in the side of the tube, giving it a compass of over three octaves.

Ophidia. [SNAKES.]

Ophioglossum, or ADDER'S-TONGUE, a genus of Pteridophyta (q.v.) forming, with the moonworts (q.v.) (*Botrychium*), the class *Ophioglossaceæ*, which, though commonly classed with ferns (q.v.), differ from them in several important structural characters. The genus includes a small number of species, one of which is British, scattered over most of the globe, none over a foot in height. The prothallium is subterranean, destitute of chlorophyll, tuber-like, and monœcious. The antheridia and archegonia are both deeply sunk in its surface. The stem of the sporophore stage is very short, unbranched, very slow in growth, containing no sclerenchyma and having a three-sided apical cell. A very few leaves are produced singly from the stem and from below each an unbranched root also with a three-sided apical cell. These roots sometimes bear adventitious buds. The leaves are not circinate in veneration. Each of them branches into a *barren* and a *fertile* lobe. The former is a leathery, ovate, sheathing, net-veined leaflet; and the latter a spike-like "fructification," along which the sporangia originate endogenously in two rows, each from a group of cells (*eu-sporangiate*).

Ophir, a region to which frequent allusion is made in the Old Testament. It furnished gold, sandal-wood, etc., for the temple of Solomon, whose ships journeyed thither from the ports of Edom. Modern scholars differ as to whether it was situated in India, in Arabia, or on the E. coast of Africa.

Ophiuroidea. [BRITTLE-STARS.]

Ophthalmia. [CONJUNCTIVITIS, EYE.]

Ophthalmoscope. This instrument is used for the examination of the fundus or back part of the interior of the eye. On looking at the transparent cornea the details of the interior of the eye are not visible, for, inasmuch as the head of the person making the examination is interposed between the source of illumination and the objects lying at the back of the eye, there is not sufficient light returning from the latter to render them visible, and all that is seen is the darkness of the pupil. By means of a mirror perforated in the centre, light can be reflected into the eye, and at the same time the observing eye, placed behind the hole in the mirror, can be made to receive the returning light from the eye which is being examined. This principle was first utilised by Mr. Babbage, but Helmholtz, in 1851, was the first to realise its important applications.

There are two methods of using an ophthalmoscope. In the *indirect method* a convex lens is interposed in front of the eye examined, and the examining eye, situated some two feet from the eye observed, views an inverted image of the interior of the latter. In the *direct method* the examining eye is placed within a few inches of the eye examined, suitable lenses are made to slide in front of the aperture in the mirror, to correct, if need be, any error of refraction in the eye of either the patient or operator, and an erect image of the fundus of the observed eye is presented for examination. The ophthalmoscope has two main uses; in the first place, it is of great importance in medicine, as

by means of it diseased conditions affecting the fundus of the eye can be detected. Such conditions are often a valuable guide in the diagnosis of disease. Optic neuritis, retinitis, and choroiditis, diseases affecting the fundus and readily distinguished by the ophthalmoscope, are far from being of merely local importance. The second great use of the ophthalmoscope is in the detection of errors of refraction.

Opie, JOHN (1761–1807), was in his youth befriended by Wolcot ("Peter Pindar") and enabled to enter upon the career of an artist. He became A.R.A. in 1786 and R.A. in 1787, lectured at the Royal Institution, and wrote a treatise on the cultivation of art in Great Britain. His chief pictures are *The Assassination of James I. of Scotland* and *The Death of Rizzio*, now at the Guildhall; and portraits of Dr. Johnson, Hannah More, Charles James Fox, Priestley, and Lady Hamilton. His second wife (*née* Alderson) wrote, besides some poems and several novels and tales, very popular in their day, *Memorials* of some historical interest, she having been a leader of literary society. She died in 1853.

Opisthobranchia, a sub-order of Gastropoda (q.v.), including the sea-slugs (*e.g.* *Doris*, *Eolis*, *Elysia*), the Sea-hare (*Aplysia*), and the Bubble-shells (*Bulla*). The shell is usually absent; if present, it is internal and rudimentary. The principal character, and that to which the name is due, is that the gills or branchiæ are at the hinder end of the body, and always behind the heart. They are all marine, and there are but few species known as fossils.

Opitz, MARTIN VON (1597–1639), "the Swan of Silesia," was born at Bober. He obtained great reputation as a writer of didactic poetry (*Buch von der deutschen Poeterei*, etc.), and was one of the earliest writers in German. He was protected by several of the minor princes of Germany, especially Count von Dohna, and was ennobled and given the poetic crown by the Emperor Ferdinand II. In 1622 he was invited to Transylvania by the celebrated Bethlen Gabor and appointed to a chair of philosophy; after his return to Germany he became historiographer of Poland. He died at Dantzic.

Opium. This well-known drug and narcotic consists of the dried juice obtained from the capsules of the opium poppy (*Papaver somniferum*). Incisions are made in these capsules, and the juice which exudes is, when dry, scraped off and collected. The plant is cultivated very largely in Eastern countries, notably in Asia Minor, Persia, Egypt, India and China, while it has also been successfully grown in the western European countries. Its properties as a narcotic appear to have been known from very early times, and its use is mentioned by some of the classical writers. In India the cultivation is a Government monopoly, and yields a revenue of over £10,000,000. Large quantities were supplied to China, and disputes in the opium traffic led to the Chinese War, which was concluded by the treaty of 1842. A large quantity is still shipped to China from India, but the Chinese growth is now

very successfully competing with the imported article. The physiological properties of opium are chiefly due to the alkaloids which it contains. Of these the most important is *morphine*, which is present to the extent of from 3 to 17 per cent. Others are also present to a small extent—*e.g.* narcotine, narceine, codeine, thebaine, papaverine, and meconic acid, of which the first three are used medicinally. It also contains a resinous substance and some other compounds of undetermined composition. The habit of opium-smoking is largely practised in China, a specially-prepared extract of opium being employed. With regard to the effect of the habit much difference of opinion exists. While probably the moderate use has no deleterious effects, yet if carried to excess it undoubtedly produces nervous and physical debility, and may completely ruin the constitution and mind of the victim. Opium-eating, practised in India, Persia, and Asia Minor, appears to be even more injurious, and, as in the case of smoking, the habit when once contracted is exceedingly difficult to break off. [LAUDANUM, MORPHINE.]

Uses in Medicine. Opium is applied externally in the form of liniment and plaster for the relief of pain. Internally administered, it diminishes the amount of the secretions, acts as an astringent, and diminishes the peristaltic movement of the bowels. When absorbed into the system, it has a specific action upon the brain, producing in small doses a kind of intoxication, and in larger doses depression, amounting in the case of poisonous doses to actual coma. The drug causes contraction of the pupil, and depresses the respiratory functions. Its most valuable use as a medicinal agent is as a narcotic; it is also employed in some cases of hæmorrhage and in certain intestinal disorders. The best-known preparations are the tincture (laudanum), the compound camphor tincture (paregoric), the compound kino powder, Dover's powder, and aromatic chalk powder, various pills containing opium, and the vinum opii. The action of opium depends mainly upon the morphine it contains, and the hypodermic injection of morphine is now frequently used in cases in which in former days opium would have been administered. Codeine is sometimes employed in the treatment of diabetes. Apomorphine is sometimes used as an emetic. *Opium Poisoning.* The symptoms of this condition are coma, with contracted pupils and stertorous breathing. The treatment consists in making every effort to arouse the patient in the interval which elapses before medical assistance can be procured. If the poisonous dose has been swallowed, it is important that the contents of the stomach should be evacuated as soon as possible.

Opoponax is a plant cultivated chiefly in the locality of the Levant, from which is obtained a juice of the same name, used to an extent pharmaceutically, and also an essential oil which is employed in perfumery.

Oporto ("the port"), the largest city of Portugal after Lisbon, is beautifully situated on rocky ground above the right bank of the Douro. The Roman "Portus Cale" became later a Christian stronghold,

which was, however, sometimes in the hands of the Moors. The citizens opposed the French in 1808, and suffered much at the hands of Dom Miguel, by whom the city was besieged in 1832-33. The cathedral was built by Henry the Navigator. There are several other interesting churches. Some of the old monasteries are now used as barracks and for a citadel and exchange. Among the fine buildings are a Crystal Palace, the hospital of St. Antony, and an English factory erected in 1788. There are also a good library, a medical school, and a fine art academy. From Oporto are exported port wine, fruits, cattle, onions, and wool. The chief industries are shipping and the manufacture of articles of clothing, as well as cork-cutting, sugar-refining, metal-casting, and distilling. In the suburb Villa Nova da Gaia, to the south of the Douro, are large wine cellars.

Opossum, any individual of the Marsupial genus *Didelphys*, with twenty-three species, peculiar to America. There are five digits on each limb; the great toe is opposable, and the tail generally long, in part naked, and prehensile. The pouch is generally absent, rarely complete, and sometimes reduced to two folds of the skin which cover the



OPOSSUM. (*Didelphys marsupialis*.)

teats. The largest species is about the size of a big cat, the smallest very little larger than a mouse. They are nocturnal and arboreal in habit, and feed on small reptiles, birds, birds' eggs, and insects. The typical species (*D. marsupialis*), which is also the largest, has the pouch complete. The colour is dirty-white, and there is a brownish circle round each eye. It has a wide range in America, and in the central and southern parts is called the Crab-eating Opossum, and has been described (wrongly) as a distinct species. The expression "to play 'possum," meaning "to dissemble," derives its force from the fact that the opossum, when closely

pressed, throws itself on its back and feigns death. In pouchless forms, like the Woolly Opossum (*D. lanigera*), the young are generally carried on the back of the mother, as they are sometimes in other species. With the opossums the genus *Chironectes* (with a single species, *C. palmatus*, the Yapock, ranging from Guatemala to the south of Brazil), makes up the family Didelphyidæ. The Yapock, about the size of a rat, is grey marked with brown, has the feet webbed, and is aquatic in habit.

Optical Illusions are produced when, owing to some peculiarity of the human eye, objects appear to be either in some place where they are not or to be different from what they really are. The phenomenon of persistence of vision, owing to which the impression on the retina of an object presented to the eye for a very short time remains for about one-tenth of a second, enables a number of illusions to be produced, as when a bright object rapidly swung round at the end of a string produces the effect of a continuous ring. If a number of different pictures, representing a moving object in different positions, are presented to the eye in rapid succession, and if a screen is interposed during the moment of change, the transition from one picture to the next is not noticed, and the figure itself seems to move; this is exemplified in the zoetrope and many similar devices. If a disc having differently-coloured sectors is rapidly rotated, it will appear to be uniformly of a colour which is a mixture of the component colours. Two objects seen separately with the two eyes may appear to occupy the same space; if one looks down a tube with one eye and holds a solid object such as a brick near the other, it is not difficult to make it appear that there is a hole through the brick. If a bird and a cage are drawn near each other on a sheet of paper which is held close to the eyes, the cage will be really seen by one eye and the bird with the other, but the bird will appear to walk into the cage. Many illusions may be produced by reflections. When an object is placed near a concave mirror and screened from direct view, an image or ghost may be seen at a corresponding conjugate focus (q.v.). When a sheet of clear glass is arranged across the stage of a theatre at an angle of 45° to the audience, an image of a figure behind the scenes will be seen on the stage; this is the well-known "Pepper's Ghost." If a coloured surface be viewed for a time sufficient to fatigue the retina, and if the eyes be quickly turned to a white surface, the latter will appear tinged with the complementary colour. The term optical illusion is commonly used to designate tricks rather than more important optical phenomena, which, of course, do really produce an illusory effect.

Optic Atrophy. This condition is detected by the altered appearance presented by the optic disc on ophthalmoscopic examination. The main symptom of the disease is failure of vision, and there is usually some alteration of the colour sense. Atrophy may be a sequel of optic neuritis (q.v.), or may occur apart from previous inflammatory change. The latter form of atrophy is met with in locomotor ataxia, in syphilis, and in some other

conditions. The treatment of optic atrophy is, as a rule, unsatisfactory, cases tending to proceed from bad to worse.

Optic Neuritis. Inflammation of the optic nerve is a condition readily detected by the use of the ophthalmoscope, which reveals the altered appearances manifested by the optic disc. In the normal condition the margin of the disc is clearly defined and not raised above the surface of the surrounding retina; in neuritis it becomes swollen and woolly-looking; the vessels coursing over it are tortuous, and in places obscured by effused material. Optic neuritis occurs in many forms of disease within the skull, and sometimes the detection of the altered appearance of the optic disc is of great importance in confirming the diagnosis of cerebral tumour or abscess, meningitis, etc. Optic neuritis also occurs in Bright's disease, syphilis, and as the result of the extension of inflammation from neighbouring parts of the eye.

Optics is the science which treats of the propagation of light, and is usually divided into geometrical and physical optics. *Geometrical optics* treats of those simple laws of the propagation of light which have been experimentally established, and uses these laws in the solution of more complex problems; *physical optics* explains experimental facts by showing that they agree with certain hypotheses on the structure of matter and space. (For *physical optics* see LIGHT.) In elementary *geometrical optics* it is usual to consider light as emanating from a mathematical point and as being made up of rays extending in all directions. These rays always travel in straight lines through any one uniform medium, unless rays from different origins interfere with each other, as in the phenomenon of diffraction (q.v.). When light falls on any object some of it is irregularly reflected or *scattered* in all directions, since the surface is not absolutely smooth, but composed of an infinite number of tiny excrescences; this scattering renders the object luminous and visible. From a smooth surface the rays are thrown back in one direction only and obey the laws of reflection (q.v.). If the object is of such a nature that light can enter it at all, the rays are bent in accordance with the laws of refraction (q.v.). Many problems of interest arise from a consideration of the paths of rays after reflection or refraction at plane or spherical surfaces. Of the greatest practical importance, however, are the problems relating to the behaviour of rays after refraction through translucent bodies known as prisms and lenses (q.v.), since upon this behaviour depends the utility of the various optical instruments, such as the microscope, telescope, etc.

Oracle, the answer of a supernatural being, generally through the medium of a priest or priestess, to some solemn and formal inquiry. The term is also used to denote the divinity or hero who gave such answers, and the temple or shrine where such answers were delivered. The divinity was supposed to inspire the human medium, and to the state of mental exaltation thus produced

Tylor gives the name of oracle-possession. The most celebrated oracles were those of the Greeks, notably that of Phœbus at Delphi and of Zeus at Dodona. The practice of consulting oracles seems to have ceased soon after the beginning of our era, and the early Christians accounted for this by attributing the responses to demons, who, they said, became silent when the Christ was born.

Orakzæ (WURUKZÆ), a people of Afghanistan, Tira district, N. and W. of Kohat; they claim to be a section of the Karâni Pathâns, but are not recognised as true Afghans, nor does the name occur in the national genealogies, though they are now assimilated to the Karâni in speech, physique, and many customs. Four main divisions—Daolat, Ishmail, Lashkar and Hamsaya—with about sixty subdivisions. The Orakzæ are naturally a turbulent people, but were reduced to order by the British expedition of 1891 under Sir W. Lockhart.

Oran, a port in Algeria, is on the gulf of the same name, 260 miles west of Algiers. The old Moorish town had attained considerable commercial prosperity, when in 1509 it was captured by the Christians of Spain and made a penal settlement. In 1708 it fell into the hands of the Turks, but was recaptured in 1732 and retained by Spain till the earthquake of 1790, when it was abandoned. It was occupied by the French in 1831, and became the capital of a province. Spaniards still outnumber Frenchmen among the inhabitants. The town is defended by two citadels, and has a cathedral, a mosque, and a military hospital. The harbour is protected by moles of recent construction. Grain and iron ore are exported.

Orang, ORANG-UTAN, the name by which the great anthropoid ape (*Simia satyrus*) of Borneo and Sumatra is known to western nations. The first name, a shortened form of the second ("man of the woods"), is applied by the Malays to a forest tribe of low culture. The anthropoid they call *mias*, *mias pappan* and *mias rambi* denoting the dark and the pale race respectively—the former with, and the latter without, fleshy excrescences on the face, and *mias kassir*, the smaller variety, described by the late Sir Richard Owen as *S. morio*. The larger form when adult is a little over four feet in height, and is clothed with long, coarse, reddish-brown hair. It is arboreal in habit, living among the topmost branches of trees, and feeding on fruit, leaves, and tender shoots, destroying much more than it eats. In confinement orangs will eat eggs and meat, and it is probable that in the wild state they catch and eat birds as do the gorilla and chimpanzee. The stories told of the ferocity of the orang are probably, no doubt unconsciously, exaggerated. Its strength makes it, when enraged, a formidable opponent, but unless attacked it seems not to molest man, and many of the specimens kept in confinement have been very good-tempered.

Orange, an ancient town in the department of Vaucluse, in the south of France, retains as a monument of its former splendour a Roman triumphal arch and a theatre. During the Middle Ages it was the capital of a small principality, and

gave its name to the House of Nassau, who in 1531 acquired the territory by marriage. On the death of William III. of England a dispute broke out between the older and younger branches for the succession, which was settled at the Peace of Utrecht by means of its sale to France by the King of Prussia as representative of the elder line, the title, however, going to the younger line, who became Kings of Holland.

Orange (from the Sanskrit *nagrunjo*, through the Arabic *naranj*, and the Italian *arancia*) is the Provençal name of *Citrus Aurantium* and some allied species, small evergreen trees belonging to the chief genus of the order Aurantiaceæ. The orange is probably a native of southern China and Burma, but grows wild and spinous in Indian jungles. It seems to have been dispersed by the Arabs and Crusaders, and is now grown in all warm regions well supplied with water and free from frost. The scattered glossy leaves are remarkable for their double articulation, having one joint at each end of the winged leaf-stalk. The fragrant white or pinkish flowers have five sepals, five petals, branched (*polyadelphous*) stamens, and a variable number of carpels. These last are united in the characteristic but variable fruit technically known as a *Hesperidium*, which is superior, has a leathery separable epicarp, a woolly mesocarp, and a membranous endocarp. The pulp is an outgrowth from the latter of large spindle-shaped cells filled with watery juice. The seeds often contain more than one embryo. As the fruit takes some months to ripen, it occurs on the tree at the same time as the next year's blossoms. There are two chief varieties or sub-species, the *sweet* or *China orange*, and the *bitter*, *bigarade* or *Seville orange*, but the Mandarin and Tangerine oranges are sometimes ranked as a distinct species. Orange wood is used by cabinet-makers. *Essence de petit grain*, a fragrant oil, is distilled from the leaves and shoots; *oil of Neroli* and *orange-flower water* from the flowers; and *essence of orange-peel* from the unripe fruit. We import the peel of the bitter orange, which is a valuable stomachic, from Seville, Malaga, and Tripoli; large quantities are candied in England, and three million pounds of marmalade are annually made from it in Dundee alone. Large quantities are brought to Amsterdam from Curaçoa for the manufacture of the liqueur of that name. Our supply of sweet oranges comes mainly from St. Michael's, Brazil, Malta, and, of late years, Florida. The import of oranges and lemons, little over a million bushels in 1863, was nearly two million in 1870, over three and a half in 1880, and nearly six million in 1890.

Orangemen, a name derived from the title of William III., which was given as early as 1689 to the Irish supporters of the principles of the Revolution. The first Orange lodge was established by the Peep o' Day Boys at Loughgall, County Armagh, after the "battle of Diamond," a contest between the Roman Catholic and Protestant population. The primary object was to deprive the Roman Catholics of the arms which they kept contrary to the law. The number of lodges and

members greatly increased during the rebellion of 1798, and rendered an effectual safeguard to Protestantism, but the movement was not countenanced by the Lord-Lieutenant. In 1808 lodges were founded in England, and, although the organisation was nominally dissolved by the Association Bill in 1825, it continued to be a potent political factor. The election of the Duke of Cumberland as Grand Master in 1835 was followed by a parliamentary inquiry, and the society was temporarily suppressed.

Orange River, THE, rises in the east of Basutoland, South Africa, and in a winding westerly course of 1,000 miles flows into the Atlantic about 70 miles above Port Nolloth. Its most important tributaries are the Hart, the Vaal, and the Caledon or Mogokara river. It is not navigable in the dry season, and the mouth is obstructed by a bar. The Orange River forms the boundary between British territory and the Orange River Free State.

Orange River Free State, THE, is bounded on the N. by the South African Republic, on the E. by Natal and Basutoland, and on the S. and W. by Cape Colony and Griqualand West. Its estimated area is upwards of 41,000 square miles. The territory, then in the possession of Dutch immigrants, was annexed by Great Britain in 1848, but six years later it was given up to the Boers, by whom the present republic was organised. The country is a large, well-watered plateau, with hills called "kopjes" standing alone in some districts. There is abundance of good pasture; and, besides horses, goats, and cattle, ostriches are kept. Cereals are grown in the district bordering on Natal; and there are coal mines in the north and diamond-mines in the south-west. Diamonds, wool, ostrich-feathers, and cattle are the chief exports. The government consists of a President (elected every sixth year) and an Executive Council of six, of whom three, including the President, are official, and a Legislative Council elected by manhood suffrage. The finances of the young state are in a flourishing condition. Bloemfontein is the capital.

Orange Tip (*Euehlæ cardamines*, Linn.), a well-known English butterfly which may be recognised by the bright orange spot on the tip of the wing and tessellated ornamentation with greenish-grey or white spots on the under side.

Oraons, a large Dravidian nation of Chota Nagpore, north-east India, with ten distinct tribal groups, speaking an uncultivated Dravidian language. The most general national name appears to be *Khuruk*, but by the surrounding peoples of the plains they are called *Dhangar*, i.e. "Highlanders."

Oratorio, a sacred musical composition, usually dramatic in character, and comprising recitatives, arias, choruses, duets, etc., with full orchestral accompaniment. It is performed without acting or scenic accessories. The name was derived from the oratorio or oratory (place of prayer) of the Chiesa Nuova of St. Philip Neri (q.v.) at Rome, where in the last quarter of the 16th century musical performances took place of which the oratorio was a later development. It was originally

designed to convey instruction in the same manner as the mediæval miracle play. It owed its existence to the revolution in musical taste which produced the opera (q.v.), and at first differed from the latter only in having a sacred, instead of a secular, subject for its theme. The first oratorio, Cavaliero's *Rappresentazione dell' Anima e del Corpo*, performed at Rome in 1600, consisted entirely of recitative, with the usual dramatic accompaniments, among which dancing was included. In spite of the works of Carissimi, Scarlatti, and Stradella, the oratorio was little cultivated by the Italians, to whose bent the opera was far more congenial. In Germany, on the other hand, the mediæval passion-play, representing the sufferings and death of Christ, developed into the *passion oratorio* or *passion music*, of which the *St. Matthew* (1729) of J. S. Bach is the most celebrated example. This composition is partly dramatic, but elsewhere epic, in form, and includes a double chorus, certain airs entitled *soliloquies*, and various chorales, in which the congregation joined. The oratorio was introduced into England by Handel, who finally abandoned the dramatic for the epic form, his two greatest compositions, *Israel in Egypt* (1739) and the *Messiah* (1741), being entirely in the latter style. The work of Handel was carried on by Haydn, who gave his *Creation* to the world in 1798. Among the most noteworthy oratorios produced in the first half of the 19th century were Beethoven's *Mount of Olives* (1803), Spohr's *Calvary* (1835) and *Fall of Babylon* (1842), and the *Elijah* (1846) of Mendelssohn. A taste for the oratorio has been kept alive by the constantly-recurring musical festivals. Parry's *Job*, Stanford's *Eden*, and Sullivan's *Golden Legend* are examples of works of the highest merit by English composers.

Oratory, PRIESTS OF THE. There were formerly two religious orders of this name. (1) The Italian order, founded by St. Philip Neri (q.v.). The Congregation is composed of secular priests, who live together under the same rule, but are not forced to take religious vows. The several communities are mutually independent, each being composed of novices, triennial fathers, decennial fathers, and a superior. The rule, which is merely traditional, enjoins mental prayer in the evening, alternating with the "discipline" of self-flagellation. The chief ministerial functions of the order are daily preaching and hearing confessions. The order was introduced into England by Cardinal Newman, who established the Birmingham Oratory in 1847. In 1849 a congregation was set up in London by Father Faber, which in 1850 became independent, and in 1854 was transferred to Brompton, where a large domed building has been erected. (2) The Congregation of the Oratory of our Lord Jesus Christ in France, founded by Cardinal Bérulle in 1613, which received the approval of Paul V. Its main object was the institution of seminaries for training priests. The society was broken up at the Revolution by the civil constitution of the clergy.

Orbit is the path described by any heavenly body with reference to the body which controls it.

The orbits of all the members of the solar system are ellipses with the sun in one focus, and since we have every reason to believe in the universal application of the law of gravitation, we assume that every other heavenly body travels also in an elliptical orbit. When the ellipse is of enormous length, as in the case of a comet, the part of its path which we are able to investigate is indistinguishable from a parabola. The orbit with which we are most familiar is, of course, that of the earth, and the great circle in which this orbit cuts the celestial sphere is called the ecliptic. The positions of other orbits are usually defined with reference to the ecliptic.

Orcagna, ANDREA DI CIONE, a Florentine artist of the 14th century, who excelled chiefly as an architect. He designed the marble tabernacle in the church of San Michele, and was chief architect of the Orvieto cathedral. Some of his frescoes in the church of Santa Maria Novella, Florence, have been restored, and a panel picture executed for San Pietro Maggiore is now in the National Gallery, London. Other churches in Florence have altar-pieces by him. He died some time between 1365 and 1390. His elder brother assisted him in his painting.

Orchard (Anglo-Saxon *orcerd* for *wyrt-geard*, "an enclosure for herbs"), a piece of ground planted with fruit-trees, usually apples or pears. In England the orchard is a common appendage of the manor-house, vicarage, or farm; but, owing to the ignorance of former generations, it is usually very unproductive. During the last fifty or sixty years, however, fruit has been grown with increasing care and intelligence, and the rules to be observed in forming an orchard are now laid down with scientific precision. The most important matters are the situation and soil. The most suitable soil is a fresh sandy loam, 18 or more inches deep, with a sub-soil of dry gravel or rock. The orchard should, if possible, slope towards the S. or S.E., and be sheltered by forest trees from the N. and E. winds in spring and by shrubberies or high hedges from the S.W. winds in autumn. Plenty of light and a free circulation of air are indispensable, whilst damp is highly injurious, so that even a bleak and exposed spot is preferable to a low-lying valley or plain where the fruit is spoilt by the morning fogs or the late spring frosts. After selecting a suitable spot, the next step is to trench the ground to a depth of about two feet, and in most cases it requires to be drained. The distance between the rows and the trees in each row ought not to be less than 25 feet. The trees intended to be permanent should be perfectly upright standards, with a clear stem of 6 feet from the root to the top, where the branches diverge. In some cases the stocks are first planted and afterwards "worked," i.e. grafted, at the requisite height. The trees should be planted near the surface, banked up with earth, and firmly staked, until they are able to resist the wind. Little pruning is necessary during the first year, and no manure should be applied, except some mulch in cases when the soil becomes dry. The intermediate spaces may be planted with dwarf-trees, bushes, clover, etc.;

but the ground should be perfectly clear for a distance of at least 3 feet from each tree. During the whole of the first year constant attention must be paid to such points as the intrusion of grubs and the formation of untimely fruit. In the second year careful pruning is required. Grass or short clover may now be grown between the trees. The apple is the principal orchard fruit in England; but cherries, pears, and plums are freely cultivated in Kent, Herefordshire, and Worcestershire.

Orchardson, WILLIAM QUILLER, was born in 1835 at Edinburgh. He studied under Scott Lander and became a skilful and popular *genre* painter. He was elected A.R.A. in 1868, and R.A. in 1877. Among his best pictures are *The Queen of Swords* (1877), *Mariage de Convenience* (1886), and *On Board the "Bellerophon," July 23, 1815* (1880), purchased by the Chantrey Bequest.

Orchestra, in the ancient Greek theatre, was the circular space between the stage and the auditorium set apart for the chorus. It denotes that part of the modern theatre or opera-house which is assigned to the band, and hence is frequently used of the band itself.

Orchidaceæ, the most numerous order of Monocotyledons (q.v.), including some 5,000 species distributed throughout the world. They are perennial herbs or shrubs, growing terrestrially in temperate climates, generally with tuberculate roots; but in tropical forests becoming epiphytes, clinging with fibrous roots to the branches of trees. These roots have sometimes a spongy absorbent



ORCHID. (*Orchis mascula*.)

layer or *velamen* externally, and the stem is often a green *pseudo-bulb*. The leaves are generally sheathing, and the flowers either solitary or in spicate or racemose clusters. They are sometimes sweet-scented, but in other cases foetid. Though the beauty and interest of the order depend upon the varied form and colour of the flowers, they are nearly all fundamentally alike in

plan. There is a stalk-like inferior ovary, of three carpels but one-chambered, which is sometimes so twisted as to invert the flower. The three sepals are often petaloid and generally equal; but of the three petals which alternate with them the posterior one is commonly enlarged, sometimes spurred, pouched, or variously modified in form, and is known as the *labellum*. From its shape our British orchids get such names as Man, Bee, Fly, Lizard, or Lady's-slipper Orchis. There are traces of six stamens, and in the last-named genus, *Cypripedium*, two anterior ones of the inner whorl produce pollen; but in other orchids only the one anterior stamen of the outer whorl does so. This stamen is fused with the style into a central column or *gynostemium*,

and its pollen (q.v.) is generally aggregated into *pollinia* or *pollen-masses*. The ovules are very rudimentary, and do not appear on the placentas until after the pollen has been conveyed (generally by insects) to the stigma. The fruit is generally dry, and splits into valves. The only important useful product of the order is vanilla (q.v.); but rare species are bought by connoisseurs for greenhouse cultivation at enormous prices.

Orchomēnos, the name of two cities of ancient Greece, one being in Bœotia and the other in Arcadia. The former stood on the northern shore of Lake Copais, and was famous for a musical festival held in honour of the Graces. Its government, an aristocracy, was obnoxious to the Thebans, by whom at the close of the Peloponnesian War the city was destroyed, and the inhabitants sold as slaves. In 1880 Schliemann discovered here a royal mausoleum of great size and splendour.

Orcin, or ORCINOL, is a compound of the composition $C_7H_6(OH)_2$, which occurs in a large number of varieties of lichens. If allowed to stand in an ammoniacal solution, a reddish-brown powder is deposited which is a constituent of a number of dyestuffs, and is intimately related to the litmus so much employed in the chemical laboratory.

Ordeal (Anglo-Saxon *ordál*, *ordél*, "distribution into parts," hence "discrimination" and so "decision"), a method of testing the guilt or innocence of an accused person which was in use amongst the Anglo-Saxons. It consisted in appealing to the "direct judgment of God" as manifested in the result of some dangerous process to which the culprit was subjected. This form of trial was sanctioned by the clergy and took place in the sacred edifice. The commonest kinds were the ordeal of water and that of fire or iron. In either case the accused person prepared himself by means of three days' severe mortification, at the end of which he communicated and took an oath that he was innocent. A special service was then held, and finally the culprit took up his position between twelve opponents and twelve friends. If the ordeal was by water, he now plunged his arm into boiling water as far as the wrist, and drew out a stone or lump of iron. In the "triple ordeal" the arm was thrust in to the elbow. The other plan consisted in seizing a bar of iron that had lain on a fire till the last collect of the service had been read and carrying it for three feet. Immediately after the trial the arm was bandaged by the priest and so remained for three days. If it had healed at the end of that time the prisoner was pronounced innocent; otherwise he was convicted. There were various other ordeals which were less fully accredited—e.g. the culprit might be thrown into deep water, in which case a tendency to sink was a proof of innocence; or he might be forced to swallow the *corsned* (consecrated bread), which always choked the guilty. Some suspected persons—Emma, mother of Edward the Confessor among the number—are said to have refuted their maligners by walking blindfolded and barefoot on

red-hot ploughshares. Other ordeals very similar in their general character existed throughout Europe during the earlier part of the Middle Ages. The Anglo-Saxon ordeal survived the Conquest, and is prescribed in the Assize of Northampton (1176), but after that date it rapidly died out, owing mainly to the disfavour of the Church and the growth of the jury system. It was denounced by the Lateran Council of 1215, and finally extinguished in England in 1218 through a letter of Henry III. addressed to the itinerant justices. Methods of trial closely resembling the ordeal existed among the ancient Hebrews and Greeks, and are now practised by various savage tribes; *e.g.* on the Gold Coast inability to swallow "poison-water" is regarded as a proof of incontinence.

Ordericus Vitalis, author of *Historia Ecclesiastica*, was born in 1075. Though his mother was English and he called himself "Orderic the Englishman," he lived from the age of ten till his death (between 1143 and 1145) in the abbey of St. Evroul in Normandy. Here he wrote his history, considered valuable as an authority for the reigns of the first two Norman kings of England.

Orders, HOLY. (1) The estates of bishops, priests, and deacons, conferred by the imposition of hands of lawfully-ordained bishops. (2) The ceremony or rite by which a bishop thus consecrates ministers for the service of the Church. In the Anglican, as in the Roman Catholic and Eastern Churches, this ceremony is regarded as a sacrament. It is held that the power of bestowing grace by the laying on of hands has been transmitted to the bishops through an unbroken series of ordinations from the apostles. This is known as the doctrine of Apostolical Succession. Hence these orders are entitled *holy* or *apostolical*; they are also termed *major orders* to distinguish them from *minor orders*, which have not the same spiritual character, although they form part of the ecclesiastical organisation, and are usually conferred by a bishop (but without imposition of hands). Minor orders were instituted for the purpose of relieving the higher officers of the Church of the more secular portion of their duties. At the present time four ranks are included in the minor orders of the Roman Catholic Church—acolyte, exorcist, reader, and doorkeeper. The office of sub-deacon is now usually reckoned among the major orders. The total number of orders is, however, only seven, the offices of bishop and priest being identified in respect of their sacerdotal functions. In the Greek Church it is unusual to recognise any minor orders but those of sub-deacon and reader (anagnostes); by the Reformed Churches they are altogether rejected.

Orders of Knighthood were probably due in the first instance to the growth of the kingly power during the early feudal period. The band of chosen followers (*comites*, *gesithas*, *thegnas*) whom the military leader gathered around himself may be regarded as the germ out of which grew the notion of a body of men united by a common ideal of heroic devotion and martial enterprise. In process of time different rules, badges, and forms

of admission as oaths, etc., would naturally become attached to each separate order. Their growth was greatly stimulated by the Crusades, which added religious ardour to military enthusiasm and gave to knighthood (q.v.) an almost sacred character. [CHIVALRY.] It was then that the great orders of the Templars (q.v.), Hospitallers (q.v.), and Teutonic Knights (q.v.) came into existence. Amongst orders of an early date which still survive may be mentioned the Italian order of St. Lazarus (said to have been instituted before 1000), the Bavarian order of St. George (introduced from Palestine in the 12th century), the Spanish orders of Calatrava (1147), St. James of Compostello (1175), and Alcantara (q.v.), the Portuguese order of St. Benedict of Aviz (1143), and the Swedish order of the Seraphim (? 1280). A full description of the various British orders is given under separate headings. [BATH, GARTER, GOLDEN FLEECE, ST. GEORGE, ST. PATRICK, THISTLE, STAR OF INDIA, ETC.] In France all orders have been abolished excepting the Legion of Honour (q.v.). The Continental orders which now occupy the highest rank include the Austro-Hungarian orders of St. Stephen (1764), established by Maria Theresa as the national order of Hungary, and the Iron Crown, founded 1805 and revived by Francis I. in 1816; the Prussian Black Eagle (1701), founded by Frederick I., and the Italian Annunziata, founded 1362, and remodelled by Victor Emmanuel II. in 1869. The three highest orders are the Garter, Golden Fleece, and Annunziata, holding the first, second, and third rank respectively. The Chinese order of the Imperial Dragon was established in 1862. Japan has two military orders, the Eastern Sun (1874) and the Chrysanthemum (1876).

Ordnance. [GUNNERY.]

Ordnance Survey, the name applied to the national survey of the United Kingdom. It had its origin in a trigonometrical survey, inaugurated in April, 1784, by the measurement of a base-line by General Roy, R.E., on Hounslow Heath, which was the starting-point of a series of triangles connected with the French triangulation two years later. Soon after, the Government decided on having a general survey for military purposes of the entire kingdom on the scale of one inch to the mile. General Roy's triangulation in the south-east became the basis of the great triangulation, which was gradually extended over the whole of the British Isles and finished in 1852. The one-inch detailed survey was carried northward till, in 1824, it had reached Yorkshire and Lancashire. A large-scale survey of Ireland having then become necessary for land valuation, the English work was suspended and the staff transferred to the sister country. The Irish six-inch survey proved so useful that, on its completion in 1840, the Government sanctioned the adoption of the same scale for the unsurveyed portions of Great Britain. In 1851 ensued the long controversy termed the "battle of the scales," and for eleven years three Committees and one Royal Commission deliberated and fourteen Blue Books were presented to Parliament. The department was paralysed by the

indecision of the Legislature; large numbers of workmen were pensioned off and re-engaged, and great waste of public money took place. Eventually the following measures were decided upon—(1) A topographical map of the United Kingdom on the one-inch to a mile scale. (2) County plans of the same on the six-inch to a mile scale. (3) Parish plans on the scale of 25·344 inches to a mile of most of the cultivated districts in England and Scotland, and (4) plans on the scale of 126·72 inches to a mile of towns with more than 4,000 inhabitants; London alone with its environs was to be surveyed on the 60-inch to the mile scale. Part of the six-inch survey of Ireland has since been revised on the twenty-five-inch scale at the expense of the Landed Estates Court, the former scale having proved insufficient for the purposes of land-sales. It would be difficult to give within the limits of this article an idea of the lavish expenditure of public money on indifferent or worthless surveys instituted from time to time to meet pressing demands of the moment. Suffice it to say that in 1842, after the passing of the Tithe Commutation Act in 1856, when the Inclosure Commissioners desired fresh surveys and maps, and in 1845, at the time of the railway mania, sums aggregating in all many millions were spent, and, for the most part, wasted.

The Great Triangulation rests on two principal base-lines, and forms bases of verification, measured with Colby's ten-feet compensation bars, which are in themselves a marvel of scientific contrivance and exactitude. By means of this trigonometrical survey the position of about 250 points dotted over the country has been determined with the most refined precision. Among various important scientific undertakings which have emanated from the foregoing may be mentioned the connection of the French, Belgian, and English triangulations, the comparison at Southampton of several national standards, the investigation of the figure and specific gravity of the earth, and the measurement of an arc of the 52nd parallel of latitude from Valentia, in Ireland, to Oursk on the River Ural. In 1870 the Ordnance Survey (originally under the old Board of Ordnance) was transferred to the Office of Works, and in 1890 it was placed under the Board of Agriculture. The principal works of the survey at present in hand are the revision and extension of the Survey of London, the re-survey of six Scotch counties on the 25-inch scale, and the re-survey of Ireland on the 25-inch scale. The survey consists of about 2511 persons, including 27 officers and four companies of Royal Engineers, and about 2030 civilian assistants, labourers, and chainmen. The parish and town plans are published at the head-quarters at Southampton by zincography, and these are reduced by photography to the six-inch scale for engraving on copper. For the one-inch scale a special drawing is prepared, also for engraving on copper. Besides its purely routine functions, the Ordnance Survey is called upon to discharge a variety of kindred duties, many beyond the limits of the United Kingdom. It has executed plans of the high-water line and areas of foreshores in

these realms for the Commissioners of Woods and Forests, maps of the river systems and catchment basins in England and Wales, and a number of miscellaneous surveys and plans for other departments; while in Canada, Gibraltar, and other parts of the world it has plotted large scale surveys for defensive works and other military purposes. The department is also a school for topographers, and parties of surveyors have been trained and equipped at Southampton for the Cape of Good Hope Survey, the Oregon Boundary Commission and the British Columbian expedition; while the Ordnance Surveys of Jerusalem and Sinai, though not paid for from public funds, owed much of their success to their connection with Southampton, which also supplied the working surveyors for the Palestine Exploration Fund. The Parliamentary vote for the Ordnance Survey for the financial year 1893-94 was £218,710.

Ordovician, or **ORDOVIAN**, from the Ordovices, an ancient tribe of central Wales, is a name recently applied to a great system of rocks known by Sedgwick as Upper Cambrian and by Murchison as Lower Silurian; but containing a distinct assemblage of fossils. They consist of greywackes, sandstones, grits, flagstones, shales or slates, with limestones in the upper part, and important contemporaneous lavas and tuffs; and they cover a large area in Wales, Shropshire, the Lake district, South Scotland, and the Isle of Man, passing conformably downwards into the Cambrian (q.v.). Their most characteristic group of fossils is that of the graptolites (q.v.); but trilobites (q.v.), such as *Asaphus*, *Ogygia*, and *Trinucleus*, brachiopods, such as *Orthis*, and the gastropods *Murchisonia* and *Euomphalus* were abundant. In the limestones corals for the first time become numerous. The system is subdivided as follows:—

Lower Llandovery Series.—1,000 feet. Grits and sandstones.

Bala and Caradoc Series.—6,000 to 12,000 feet. Sandstones, slates, and grits, with Bala and Coniston limestones.

Llandeilo Flags.—2,500 feet.

Arenig or Stiper-stone Series.—4,000 feet. Dark slates and sandstones, with Skiddaw slates, 12,000 feet.

Oregon, one of the western states of the American Union, has Washington on the north, Nevada and California on the south, Idaho, on the east and the Pacific on the west. The total area is 96,030 square miles. The name was once given to the whole country between the Rocky Mountains and the sea, which was claimed both by Great Britain and the United States. After a period of joint occupation, the Oregon boundary question caused, in 1845, a misunderstanding between the two countries; but this was put an end to by a treaty, made in the following year, which defined the north-western frontier, though it left some minor questions to be decided by subsequent arbitration. The surface of Oregon is, on the whole, mountainous, and there were formerly many volcanoes. The chief ranges are the Coast Range, the Cascade Mountains parallel with them, containing several high peaks, such as Mount Jefferson over 10,000 feet, and Mount Hood over 11,000 feet; and the Blue Mountains in the north-east. The principal rivers

are the Columbia, which separates Oregon from Washington; and the Snake, which skirts the Idaho frontier. The former is one of the best fishing rivers in the world, abounding in salmon, trout, and sturgeon. The climate is temperate and moist in the west, but drier farther east, where there are some inland lakes. Cereals of all kinds are largely grown in the state; and large quantities of apples, peaches, plums, grapes, and cherries are exported. Oregon is also celebrated for its timber. It is also well provided with minerals, wool from its sheep, and salmon caught in the Columbia and tinned. Oregon became a territory in 1848, and was formed into a state in 1857. It sends one representative to Congress. Portland is the capital, and Salem the next largest town.

Orejones, South American aborigines occupying an extensive territory in the Upper Amazon basin above Loreto, and in the Iça (Putumayo) valley. They pierce the ears for the insertion of large wooden plugs, by which the lobes are extended down to the shoulders, whence their Spanish name, *Orejones*, meaning "Big Ears." They are at a very low level of culture, of short stature, and weak constitution, going naked, and living in low huts shaped like the roof of a house, and entered by means of a trap which admits scarcely any light, but also helps to exclude the flies which swarm in their watery woodlands.

Orel, a government in the centre of Russia in Europe, having an area of 18,000 square miles. Its capital, twice burnt in the present century, has a flourishing trade in corn, ropes, and tallow.

Orelli, JOHANN KASPAR VON (1787-1849), a learned Swiss scholar born at Zürich, in whose university he was professor of classical philosophy. His editions of Horace, Cicero, and Tacitus are still in use, and are greatly valued by scholars.

Orenburg, one of the governments of Russia, on the Ural boundary. It has an area of 73,794 square miles and a population consisting largely of Bashkirs and Cossacks. Orenburg, the chief town, situated on the Ural river, was formerly an important frontier fortress; it is now a principal trade centre, which exports corn and metals, and receives the products of Turkestan.

Ores are minerals containing metals in such a state that they are capable of being extracted by metallurgical processes. The ores consist usually of oxides, sulphide or carbonate of the metal, and occasionally of chloride, phosphate, and other compounds. A quantity of earthy matter, gangue, is always found mixed with the ore, and for the separation of this the ore, before being subjected to the furnace actions, etc., has usually to be treated to preliminary treatment—ore-dressing. [METALLURGY.]

Orestes, son of Agamemnon, King of Mycenæ, and Clytæmnestra, his wife, returned from his hiding-place at Phocis with his friend Pylades and avenged the murder of his father on Clytæmnestra and the usurper Ægisthus. Pursued by the Furies, he fled to Athens, and was purged

by the Areopagus; or, according to the story told by Euripides, fled to the Tauric Chersonese (the Crimea) in order to carry off the statue of Artemis. This with Pylades he succeeded in doing after being recognised by the priestess Iphigenia his own sister, who escaped with him.

Orfella (URFILA), a fierce and powerful people North Africa, about the shores of the Great Syrtis Tripolitana; they speak Arabic, call themselves Arabs, and claim to have migrated from Egypt about the 9th century; but their customs, sub-tribal names and other indications show a large admixture of the aboriginal Berber element. The Orfellas own all the wells along the caravan routes, and are much dreaded by the surrounding populations; owing to their predatory excursions, the Tirsas oasis, formerly thickly peopled and highly cultivated, has been completely abandoned.

Orfila, MATTHIEU JOSEPH BONAVENTURE (1787-1853), author of the *Traité de Toxicologie Générale* (1813), was born in Minorca. He took the degree of M.D. at Paris, where he gave famous lectures on chemistry, botany, and other subjects. In 1819 he became a French citizen, and in 1823 exchanged the chair of jurisprudence for that of chemistry. He was deprived of the post of dean of the medical faculty in 1848 owing to his moderate opinions.

Organ, the most elaborate and grandest form of wind-instrument. The structure of the organ is extremely complicated, so that only its main features can be discussed here. The several parts fall naturally, according to their functions, into three divisions: (1) the *wind-supply*, regulating the admission and distribution of condensed air or "wind"; (2) the *pipe-work*, consisting of the sets of pipes, in which the musical sound is produced through the intonation of the wind; (3) the *action*, comprising the apparatus by means of which the player controls the instrument. The wind is admitted through two or more oblique bellows, called *feeders*, to the horizontal *storage-bellows*, whence it passes through the *wind-trunks* into the *wind-chests*, boxes placed immediately below the pipes. To the upper portion of each wind-chest is fixed an *upper-board*, a contrivance for carrying the wind through valves to one or more of the pipes. The *pipes* are attached to the upper-board, several of different quality being arranged one behind the other, so as to communicate with the corresponding digital of the key-board. The transverse rows formed by the pipes are called *stops* or *registers*: they have the same quality throughout, and at least one pipe in each stop communicates with each digital. The various kinds of pipes, which may be either of wood or metal, fall into two main divisions: *flue-pipes*, in which the tone is produced by means of a current of air which rushes through a slit at the lower end of one side and impinges against the sharp edge above it; and *reed-pipes*, in which the musical note is due to the vibration of a tongue inserted in an aperture in the reed through which the wind passes. The group of stops placed above each wind-chest is

called a *partial organ*. The large organs used in cathedrals commonly comprise four of these partial organs—viz. the *great organ*, the *choir organ*, the *swell organ*, and the *pedal organ*, to which is sometimes added the *solo organ*. The *action* consists of a key-board for each partial organ, a stop-knob for every stop, etc. Key-boards are of two kinds, *manuals* and *pedals*, worked by the hands and feet respectively. The compass of the manuals is usually from C C to F in alt ($4\frac{1}{2}$ octaves), that of the pedals from C C C to F ($2\frac{1}{2}$ octaves). The effect of pressing down a digital on one of the key-boards is to open the corresponding valve between the wind-chest and the pipes. The valve admits the air to a groove running beneath the row of pipes belonging to that key which opens into it through bores at their lower extremities. But at the same time the player may, if he chooses, shut off the wind from the pipe in any set by pushing in one of the stop-knobs which lie conveniently within his reach. These stop-knobs work the cross-slides which pass between the grooves and the pipes above them. It should be added that the key-boards are so arranged as to give a player the control of the whole organ at the same moment.

The water-organs in use amongst the ancient Greeks survived the invention of the bellows, which probably took place about the middle of the 4th century A.D., remaining in use till the latter part of the 9th century, when bellows organs began to take their place in churches. The progress in the art of organ-building which took place in the following centuries was due to the care bestowed by the regular clergy on the construction of the small instruments used in monasteries. Up to the middle of the 17th century excellent organs were made by native English craftsmen; but after that date the industry fell into the hands of foreign immigrants.

Orientation, the adoption of an eastward position in worship or the construction of churches in such a manner that the upper end of the chancel has an eastern direction. The latter practice has been more strictly followed in northern countries than in the south of Europe.

Origen, one of the greatest of the Christian fathers, was born in 185 or 186. He was educated by his father Leonidas, a Christian who suffered under the persecution of Septimius Severus. In 203 he was placed at the head of the celebrated catechetical school of Alexandria, where he lived for nearly thirty years. He earned his living by copying MSS., and lived a highly ascetic life, even carrying out literally the precept suggested by Matthew xix. 12. He learned Hebrew, and made a special study of Plato and the Stoic writings in order to realise the heathen point of view. In these years he also made journeys to Palestine and Arabia, but was recalled by Demetrius, Bishop of Alexandria, who was displeased at a layman having preached. He refused to ordain him, and when this had been done by another bishop about 230 Origen was deposed and banished. He now settled at Cæsarea, in Palestine, where he set up a celebrated school, Gregory Thaumaturgus being one of his

pupils. Thence he made journeys to Cappadocia, Nicomedia, Arabia, and Athens. During the Decian persecution he was imprisoned and tortured at Tyre, where he died probably in 254. Fragments only exist of the *Hexapla*, a gigantic piece of textual criticism, in which the Hebrew and all existing Greek versions of the Old Testament were placed side by side. The chief apologetic work, an answer to an attack by a certain Celsus on Christianity, is extant in the original, and is invaluable.

Orinoco, a river of South America, rises in the south-east of Venezuela, and flows in a north-westerly direction as far as San Fernando de Atabapo, where it joins the Inirida. It then flows due north as far as the middle of Venezuela, when, having been joined by the Meta, the Apuse, and several other streams, it takes an easterly turn, and enters the Atlantic by many mouths about 200 miles south of Trinidad. The total length of the river is 1,550 miles, of which more than half is navigable, the cataracts of Atures, however, making a considerable break. The Orinoco drains an extent of country whose area amounts to nearly 370,000 square miles, and overflows its banks between May and January.

Oriole, any bird of the Passerine family Oriolidae, with five genera, and especially of the type-genus Oriolus, with twenty-four species, from the warmer regions of the Old World. The plumage is very brilliant, consisting of shades of yellow boldly marked with black. The best-known species, *O. galbula*, the Golden Oriole, is about nine inches long; a deep golden yellow is the prevailing colour; there is a blotch of the same hue on the black wings, and the dark tail feathers are edged with yellow. In summer it is common in central and southern Europe, ranging eastwards to Irkutsk, and its winter quarters are in South Africa. It is an occasional British visitor in spring, and there seem to be a few instances of its breeding in this country. It is a shy bird, frequenting groves or the dense foliage of tree-tops. In the spring it feeds chiefly on insects, but when fruit is ripe it does considerable damage to the crops, though it probably repays the mischief by the insect pests it consumes. The nest is usually attached to both branches of a horizontal fork, from which it depends. The name Oriole is given in America to the Hang-nests.

Orion, the subject of several Greek myths, was a mighty hunter, the son of Boeotian parents. Some stories make him the lover of Artemis, by whom he was unwittingly slain through the arts of Apollo. Another myth makes her slay him from jealousy of Eos, who had carried him off to Ortygia; and yet another ascribes his death to the sting of a scorpion. Orion, after his death, was placed among the stars.

Orissa, a province of India, which was formerly a large kingdom, now forms the south-western portion of Bengal. In 1568 the kingdom was conquered by the Great Mogul, from whom two centuries later it was wrested by the Mahrattas. It became part of the East India Company's territory

in 1803. It is now divided into a commissioner-ship, the coast country from Balasor to Lake Chilka, and the tributary states, a strip of hill-country in the interior. This country is the seat of the worship of Siva and Vishnu, and at Puri is the image called Juggernaut. It was the scene of a severe famine in 1868-69. The country is irrigated by numerous canals; and the delta of the Mahanudi, in which is Cuttack, the chief town, covers a large part of the commissioner-ship. The native tribes offered human sacrifices until recent times.

Orizaba, a volcano in Mexico, 25 miles N. of the town of the name, is over 18,000 feet high. No severe eruption has occurred for many years.

Orkney Islands (the *Orcades* of Ptolemy), a group of islands separated by the Pentland Firth from Caithness, Scotland. They are 90 in number, but the only ones of any size or importance are Mainland or Pomona (207 square miles), Hoy, the most picturesque, Sanday, and Westray. At the end of the 9th century they were conquered by Harold Harfagr of Norway, and later passed from Norway to Denmark, whence they passed in 1468 to James III. of Scotland as security for the dowry of his wife, the Danish princess Margaret. The Danish kings did not finally abandon their pretensions till the marriage of Anne of Denmark to James VI. of Scotland. The inhabitants are of mixed Scandinavian and Scottish origin. Only about half the land is cultivated; but fishing and cattle-rearing are largely carried on. The Orkney and Shetland Isles send a joint member to the Imperial Parliament.

Orleans (*Orléans*), a celebrated French city, is in the department of Loiret, on the right bank of the river Loire. It was formerly the capital of the province of Orléannais. Here, in 52 B.C., the Gauls rose against Julius Cæsar; and the place was afterwards besieged by Attila (451 A.D.), by the Northmen twice in the 9th century, and by the English under Bedford in 1428-29, when it was delivered by Jeanne D'Arc (q.v.). It was captured by the Germans in 1870 and recaptured by the French, who, however, again lost it after the defeat of the Army of the Loire in December. Among its notable buildings are the cathedral, the Musée, which was formerly the town-hall, and the Mairie, a 16th-century edifice. There are three statues of the Maid of Orleans. A large forest covers the surrounding country. Orleans has many commercial advantages; market-gardening is the chief industry.

Orleans, **DUKEDOM OF**, an appanage of the French royal family, was first granted to Louis, brother of Charles VI., in 1392, who was Regent of France during that king's madness and was assassinated by the partisans of Jean "sans Peur," Duke of Burgundy, in 1407. CHARLES, his son (1391-1465), carried on the feud with the house of Burgundy. He was taken prisoner at Agincourt (1415), where he commanded the French army, and lived more than 20 years in England. He was released by the intervention of Philip the Good of Burgundy in 1440, and put an end to the family feud by marrying as his second wife the duke's niece, Mary of

Cleves. His first wife had been the widow of Richard II. of England. On the succession of his son LOUIS (Louis XII.) to the throne, the duchy of Orleans reverted to the Crown. It was revived in the person of Jean Baptiste Gaston (Gaston d'Orléans), third son of Henri IV., when in 1626 he married Marie de Bourbon. He died in confinement at Blois in 1660. The title having again lapsed, Louis XIV. conferred it on his brother. PHILIPPE, husband of Henrietta Anne, sister of Charles II. of England. On his death in 1701 it passed to his son, PHILIPPE (1674-1723), known in history as the Regent Orleans. His military talents—shown in Flanders, Italy, and Spain—excited the jealousy of Louis XIV., on whose death, however, he became Regent of France. With the help of Dubois, he reversed the traditions of his uncle by allying himself with England and Holland, and expelled the Pretender from France. He died a few months after Louis XV. had been declared of age in 1723, less than 50 years old. His great-grandson, LOUIS PHILIPPE JOSEPH, called "Egalité," born in 1747, bore the title Duc de Chartres till, on his father's death, in 1785, he became Duc d'Orléans. He became the bitter enemy of Marie Antoinette, especially after the birth of her children, by which his chance of succession to the Crown was removed. He made himself popular with the Paris mob by throwing open the gardens of the Palais Royal and distributing money with a lavish hand. In the Convention he was one of the deputies for Paris, and voted for the death of Louis XVI.; but his short-lived popularity came to an end when his son went over to the Austrians, and he was himself tried and guillotined at the end of the same year (1793). Philippe Egalité was intimate with George IV. when Prince of Wales, and affected things English even more than the Regent Orleans. The DUC DE MONTPENSIER, 5th son of Louis-Philippe (q.v.) (b. 1824), also bore the title. In 1846 his father married him to the Infanta of Spain, sister of Queen Isabella. He became a candidate for the throne of Spain after the revolution, but his chances were ruined when he killed his cousin, the Infanta, in a duel in 1870. He spent the remainder of his life in retirement.

Orloff, GRIGOR GRIGORIEVITCH (1734-83), the favourite of the Tsarina Catherine II. of Russia, planned for her the assassination of her husband, Peter III., which was carried out with the help of his four brothers in 1762. Alexis being probably the actual murderer. The latter, who survived till 1808, received the title Tchesmenskii as a reward for his destruction of the Turkish fleet at Tchesme in 1770. Gregory gained some distinction in the Turkish wars and in alleviating the plague of Moscow in 1771, but was supplanted in later years by Potemkin.

Ormonde, JAMES BUTLER, 1ST DUKE OF (created in 1661), commanded the English forces in Ireland at the time of the rebellion of 1641, and afterwards tried to hold Ireland for Charles I. He accompanied Charles II. into exile, and after the Restoration was again for two periods Lord-Lieutenant of Ireland. He died in 1688. JAMES, 2nd Duke, his grandson, was born in 1665. He deserted

James II. at the Revolution, and, serving in the wars of William III., was made prisoner at Landen (1693). During most of the reign of Anne he was a popular Lord-Lieutenant of Ireland, but left that country in 1710 to take Marlborough's command in Flanders. Soon after the death of Anne he fled to France, the Whigs having determined to impeach him for his conduct of the war. He obtained the dismissal of Bolingbroke by the Pretender, and was to have commanded the army which Alberoni intended to invade England in 1719. After the failure of the Spanish schemes he lived in retirement at Avignon, and died in 1745.

Ormuz, a small town on an island at the entrance of the Persian Gulf, near which stood in the Middle Ages an important trading city. It was captured by Albuquerque in 1507, and remained in Portuguese hands till 1622, when it was taken by an English fleet and given back to Persia. The town is now in ruins, but the fort remains.

Ormuzd (*Ahuramazda*), the Supreme Deity of the Persians and modern Parsees.

Orne, a department of France which takes its name from a river which flows through it, has Calvados and Eure on the north, Mayenne and Sarthe on the south, and Eure-et-Loire on the east. The total area is 2,353 square miles. The surface is hilly and wooded in the south. Cider-brewing and the rearing of horses and cattle are the chief industries. Alençon is the largest town.

Ornithology, the branch of zoology which treats of birds (q.v.).

Ornithoptera, a genus of swallow-tailed butterflies (q.v.) (*Papilionidæ*) which inhabits India and Malaysia and is remarkable for the great size of the individuals belonging to it. The expanse of wing varies from about 3 to 9 inches. The males are usually of a fine velvety black colour.

Ornithorhynchus (*O. anatinus*), called also the Duck-billed Platypus, or Duck-bill, a lowly aquatic mammal from Tasmania and Australia, the sole species of its genus, which constitutes one of the two families that make up the Monotremes (q.v.). The adult male is about twenty inches long and the female somewhat less. The strange duck-like bill is formed by the horny sheath which covers the expansion of the premaxillary bones and the mandible. In 1888 Mr. Poulton found teeth in an embryo, and in 1889 Mr. Oldfield Thomas found functional teeth in some young skulls which he examined. When worn away by friction these teeth are not replaced by a second set, but horny structures are developed, those in front being sharp-edged, while those at the back of the mouth function as molars. The thick soft fur is glossy brown in colour. Each limb bears five digits, armed with strong claws, and on the fore limbs the membrane between the digits projects beyond the claws, making these limbs admirable swimming organs. The membrane is turned back on the palm when the animal is walking or burrowing. There is a perforated spur on the hind foot in the young, which disappears in the female. It communicates

with a gland, and seems to be a poison organ, but there is only one recorded instance of its use, which is probably limited to certain seasons. The burrows are made in river banks, and have two entrances, one above and one below the water-level. These animals feed on insects, molluscs, and worms, which they take under water and stow away in their cheek pouches, rising from time to time to masticate and swallow their prey. Their sense of smell appears to be fairly acute. The aborigines always asserted that these animals laid eggs, and their story was believed by many Europeans, but no proof of its truth was obtained till 1884, when Mr. W. H. Caldwell's discoveries put the matter beyond doubt, and made it clear that two eggs are laid at a time, each about $\frac{3}{4}$ inch long, with a "soft" shell, probably broken by the bill of the young.

Ornithosauria, a name proposed by Professor H. G. Seeley for the Pterosauria, the group of fossil reptiles that includes the Pterodactyl (q.v.), to indicate his belief in their close relationship to birds.

Oroks (OROKOS), a people of the island of Sakhalin, east coast of Manchuria, occupy the northern and central districts, contingent southwards on the Ainu, who are the true aborigines of the island. The Oroks are a branch of the Tungus, with pronounced Mongolic features and a language closely related to that of the Olchas (Oltas) of the neighbouring mainland, whence they appear to have emigrated at an unknown date. They dwell in sugar-loaf huts, and live by fishing and hunting, pursuing the reindeer, which they have learnt to tame, using it both as a mount and pack animal. Since the occupation of Sakhalin by the Russians the Oroks have been greatly reduced, and in 1892 scarcely numbered more than 400. (Veniukoff.)

Oronchon (OROCHON), *i.e.* "Reindeer Keepers," a general tribal name occurring in many parts of Siberia. The best known are a Tungus people of the Amur basin, reaching from the Daurian frontier for sixty miles eastwards to the Amur, where it is joined on its left bank by the Oldo.

Orontes, a Syrian river, now known as Nahr-el-Asi, rises near Baalbec, and enters the Mediterranean after a course first in a northerly and then a westerly direction of 147 miles. The banks are in some places 300 feet high, and are clothed abundantly with figs, vines, sycamores, and myrtles. Antioch is on this river some twenty miles from its mouth.

Orosius, PAULUS, a native of Tarragona, Spain, wrote, in the fifth century, a compilation which he called *Historiarum adversus Paganos Libri VII.* It is of little value, but was a popular text-book in the Middle Ages, and was translated by King Alfred. There are two modern English versions, one by H. Sweet. Orosius was acquainted with St. Augustine, and wrote against Origen.

Orotchi (KEKAR), a people of the Maritime Province, East Siberia, scattered in small groups over the whole region from the coast to the Sikhota-Alin range, and about the head-waters of the Ussuri; are a branch of the Tungus family, but have become largely mixed with the Chinese in

the southern districts, where they are called Mantze and Ta-tze; flat, square features, high cheekbones, thick lips, olive-brown skin, slant eyes, long lank black hair; language closely related to that of the Goldi, a Tungus people of the Amur basin.

Orphanage, an institution for orphans. There are many established in England.

Orpheus, the hero of many Greek myths, was said to have received the gift of the lyre from Apollo, whom some made his father. With his music he charmed both animate and inanimate nature, and by its power saved the Argonauts from all perils in their voyage, and induced Pluto to let him take away his wife, Eurydice, from Hades. Having, however, looked upon her as they ascended, he again lost her. He himself met with a violent death, being either torn in pieces by the Mænads for refusing to worship Dionysus, or smitten down by the thunderbolt of Zeus for revealing the divine mysteries.

Orrery, a working model of any system of heavenly bodies. Various spheres would, for instance, represent the planets, and these would be geared up together in such a way that they could move around a model sun in the same directions as do actual planets. Their velocities too would all be the same fraction of the actual velocities, so that their motions with respect to each other would be the same as the movements we view in the celestial sphere. The Earl of Orrery, in 1745, paid for the construction of the first one (designed by a clockmaker, George Graham), hence the name.

Orris Root, the rhizome of *Iris germanica*, *I. pallida*, and *I. florentina*, which has an odour of violets, and has long been used for tooth-powder, hair-powder, and liqueurs. It is imported from Leghorn, Trieste, and Mogador, that from the first-named port being most esteemed.

Orsini, FELICE (1819-58), an Italian revolutionist, in 1838 took up the study of law, and went to Bologna, where Mazzini's party of Young Italy enlisted his active sympathies. He and his father took part in the rising of 1843, and Felice was condemned to the galleys for life, but was pardoned later. In 1848 he fought in the service of the Venetian Republic and, when disturbances broke out in Rome, became a member of the Roman Assembly. On the failure of the movement he retired to Genoa and Nice and, as an ardent Mazzinist, was constantly in the political movements of the time. At Mantua in 1855 he was condemned to death, but escaped in 1856 to London, where he published *Austrian Dungeons in Italy*. Later he joined with others in an attempt to assassinate Napoleon III. when he, with the Empress, was returning from the opera. For this attempt, which caused some loss of life, he was executed.

Orthidæ, a family of Brachiopoda (q.v.), members of which are common in the Palæozoic rocks. *Orthis*, the type-genus, ranges from the Lower Silurian to the Carboniferous, as does also the second important genus, *Strophomena*.

Orthoceras, a genus of Nautiloidea (q.v.),

which includes long, straight-chambered shells which are often of great length. The genus ranges from the Upper Cambrian beds to the Trias of the Alps. It is, however, mainly characteristic of the lower part of the Palæozoic group. It is the type of the family *Orthoceratidæ*. Some large species in China are cut open and polished and then used as religious symbols; they have been described by travellers as "Pagoda shells."

Orthoclase (POTASH-FELSPAR), typically consisting of 64.6 per cent of silica, 18.5 of alumina, and 16.9 of potash, and crystallising in the Oblique system. It occurs in large crystals in porphyritic rocks, such as the granite of Shap Fell, and is usually opaque, white, cream-colour, or pink. Its hardness is 6, and its specific gravity 2.5; it is scarcely affected by acids, and is only fusible at the edges with the mouth-blowpipe. It occurs often associated with quartz and hornblende, as an essential constituent of granite, syenite, felsite and gneiss, and readily undergoes kaolinisation or hydration into china-clay.

Orthoptera, an order of insects in which the front wings are leathery, and hence are known as *tegmina*. The pupa is active, so that the metamorphosis (q.v.) is of the type known as incomplete. The order includes the cockroaches, crickets, locusts, grasshoppers, etc. Most of the members inhabit the tropics. There are some sixty species in England.

Ortolan (*Emberiza hortulana*), the Green-headed Bunting, native in Europe and in western Asia, migrating southward in autumn, though its winter quarters are not accurately made out, and returning about the end of April or the beginning of May, and then ranging as far north as the Arctic Circle. The length is a little over six inches, and the plumage greenish-grey. In habits and general appearance the ortolan resembles the yellow-hammer, but has less brilliant plumage. These birds feed on insects, especially beetles, and seeds. They are highly esteemed for the table, and in their northward and southward flights large numbers are netted and fattened in dark rooms for the market.

Ortyx. [QUAIL.]

Orvieto, an Italian town in the province of Umbria, is on a height near the confluence of the Paglia and Chiavia, sixty miles N.W. of Rome. It is a well-built town, and contains a Gothic cathedral of marble (possessing some good sculptures and paintings), the Petrunelli Palace (with fine paintings), the Gualtieri Palace (with cartoons of the old masters), a bishop's palace, and a fine Jesuit college.

Oryx, a genus of antelopes with four species: the Leucoryx (*O. leucoryx*), ranging from Gambia to Abyssinia; the Gemsbok (*O. gazella*), from South Africa; the Beisa (*O. beisa*), from eastern Africa; and the Beatrix antelope (*O. beatrix*), from Arabia.

Osages, North American aborigines, a distinct branch of the Siouan (Dakota) family, who formerly roamed a considerable part of Arkansas and the north-west parts of Indian Territory. Three main divisions: *Big Osage* (highlanders), *Little Osage* (lowlanders), and *Arkansas Band* (upland forest

people), nearly all now in the Osage Agency, Indian Territory.

Osage Orange (*Maclura aurantiaca*), an American tree, with fruit resembling green warty oranges; and shiny ovate leaves. The wood is strong and flexible.

Osaka, a considerable city and treaty port of Japan, is situate upon the island of Hondo, in the estuary of the Yeddo-Gawd, 28 miles S.W. of Kioto. No less than 15 canals pass through the city, and communication is kept up by numerous wooden bridges. A railway leads from Osaka to Yeddo, but most of the trade is carried on at Hiogo on the other side of the river. A strong citadel protects the city, and the river banks are lined with fine country-houses.

Osborn, SHERARD, ADMIRAL (1822-75), an English explorer, was the son of Lieutenant-Colonel Osborn. He entered the navy in 1837, and in 1838 commanded a gun-boat. He interested himself in the search for Sir John Franklin, and commanded a ship in the expedition, and made a notable sledge journey to the W. of Prince Edward's Island. From 1852-55 he commanded the Arctic ship *Pioneer*, and during the Russian War was employed in the Sea of Azoff. He took part in the second Chinese War, and ascended the Yang-tse-kiang for 600 miles. In 1865 he became agent to the Great Indian Peninsula Railway, and in 1867 managing-director of the Submarine Telegraph between England and the East and Australia. He was made Rear-Admiral in 1873, and to the end of his life interested himself in Arctic research.

Oscans, one of the chief branches of the Italic division of the Aryan family, were regarded as the aborigines of central Italy south of Latium by the Greeks, who called them *Opici*, from *ops*, "land," (whence *Opsei*, *Osci*); they were Romanised soon after the Samnite Wars, but their language, a sister to Latin, presenting some marked phonetic peculiarities, long survived in the hilly districts. Of this language the most interesting record is the Agnone bronze, found (1848) in a ruined temple and written on both sides from right to left in an old Italic alphabet like the Etruscan; date unknown, but probably about 150 B.C.

Osceola (1804-38), a Seminole chief, was born in Georgia, but when quite young went with his mother to Florida, where he attained a high post among the Indians. In 1835 his daughter—he had married a fugitive slave—was seized as a slave. His threats of revenge gained punishment for him at the hands of General Thompson, and six months later he killed the general and others. He then put himself at the head of a band of his men, destroyed a military force that was sent against him, and held his own for two years, being then seized while under the protection of a flag of truce. He was imprisoned in Fort Moultrie till his death the next year.

Oscillatoria, a group of blue-green algæ, inhabiting fresh or salt waters, damp grounds, or hot springs, consisting of multicellular filaments in

a mucilaginous sheathing often felted together in a scum. They derive their name from a complex system of spontaneous movements, the filament bending, rotating on its axis, and creeping backwards and forwards.

Oshkosh, a town of the United States of America, is in Winnebago county, Wisconsin, at the point where the Fox river falls into Lake Winnebago. There is a good harbour, and a considerable export trade in lumber and flour. The town has shingle-planing and saw-mills, breweries, tanneries, foundries, and machine-shops. Among the chief buildings are a court-house, several churches, schools, etc.

Osiander, ANDREAS (1495-1552), a Lutheran clergyman, was born near Nuremberg, where he preached and took part in theological controversy against Zwinglius. He was present at the Diet of Augsburg in 1530, and was appointed professor of theology in the university of Königsberg by Duke Albert of Prussia. In 1549 he engaged in a dispute with Martin Chemnitz and others as to justification, and afterwards opposed Melancthon. The controversy ended in the defeat of his party after his death.

Osiers. [WILLOWS.]

Osiris, an Egyptian god, the embodiment of good, as his brother, Set, was that of evil. Some considered him as the son, others as the husband and brother, of Isis and father of Horus. He is said to have conquered Egypt and to have founded a good system of laws, but to have fallen at last through the machinations of Set. He is also represented as judge of the dead, and his figure is accompanied by many symbols.

Osmanli, a branch of the Usbegs, who passed in the 11th century from the Turkoman Desert to the Iranian tableland, and thence to Asia Minor and the Balkan Peninsula. They take the name of Osmanli from Osman (Othman) I., *El Ghazi*, "The Victorious," originally a petty chief of Bithynia (1259-1326), who overran a great part of the Byzantine Empire and founded the present Turkish dynasty. The Osmanli Turks, a brave, hardy race, mainstay of the Turkish Empire, form the bulk of the rural population of Asia Minor, where they have long abandoned the nomad life of their ancestors, and are now chiefly occupied with tillage and stock-breeding. The language is pure Tûrki in structure, closely allied to the Chagatai of Turkestan, but much mixed with Arabic and Persian words and even phrases, especially as spoken and written by the upper classes, who use the Arabic character, though ill adapted to express the sounds of the Turkish language.

Osmium (Os, at. wt. 190.3), a rare metal which in its properties is closely allied to platinum, belonging to the platinum group of metals. Its chief source is the ore known as *osmiridium*, consisting chiefly of a compound with iridium. This ore is so hard and unalterable that it is employed for bearings where the most extreme hardness is desirable. It is for the same reason employed for tipping stylographic pens. It occurs chiefly in

California, the Urals, and at Katherinenberg. Its specific gravity is the highest of all known substances, being 22.43. Its salts have not been much studied, and are only of chemical interest; but one of its oxides, *osmic acid*, is used in dilute solution for hardening animal tissues for microscopic preparations. At 100° C. it gives off a very offensive odour, hence the name (Gk. *osmē*, smell).

Osmose may be best explained by describing a simple experiment. Let a small cylinder of glass, or some other suitable material, be closed at one end by a diaphragm of some porous substance—either an animal membrane or unglazed earthenware; fill this cylinder with a liquid—say alcohol—and plunge the whole in a vessel of water. The small cylinder is closed with a cork through which passes a glass tube. After the cylinder has been immersed in the water for a short time, the alcohol will be seen to rise in the tube, and during the course of a day the rise may be a foot or more. [ENDOSMOSE.] This passage of the water through the diaphragm into the alcohol is known as osmose, and differs from diffusion in that osmose takes place in one direction only, while in the case of diffusion between two liquids a constant exchange, and therefore movement in two directions, is going on. According to Graham, who devoted much time to the study of this phenomenon, osmose is really due to chemical action between the liquids and the porous septum. The rise of sap in trees, and the passage of liquids in the bodies of living creatures, is probably due to osmose, and not to capillarity, as has been often assumed.

Osmotic Pressure. [OSMOSE.]

Osmunda, a genus of ferns of which the large British species, *O. regalis*, the Royal or so-called Flowering Fern, is the type. The fronds, sometimes six feet or more in height, are leathery, and the “fructifications,” or sporangia, are confined to the terminal pinnae, which develop no green leafy tissue. The sporangia originate from cells other than those of the epidermis, and have the annulus represented by a group of thick-walled cells on one side of their apices. *O. regalis* grows in huge tufts in marshy spots.

Osnabrück, a Prussian town of Hanover, is situated on the Hase, 70 miles W. of Hanover. There is an old part—with narrow and irregular streets—and a new part, which is well built, and the suburbs contain some good houses. Among the chief buildings are the Roman Catholic cathedral and the church of St. John, and the Protestant churches of St. Mary and St. John with 12th-century tower. The town once belonged to the Hanseatic League, and the bishopric was secularised and joined to Hanover in 1803. Among the industries are iron- and steel-founding, machine- and railway-shops, bleaching, paper-, flax-, and cotton-mills, tile-making, and brewing, and the manufacture of a coarse cloth.

Osprey, FISH HAWK, or RIVER EAGLE (*Pandion haliaëtus*), the sole species of the type-genus of the Raptorial family Pandionidæ, almost universally distributed. There is another genus (*Poliaëtus*)

with two species, ranging from India to the Sandwich Islands. The osprey is an occasional British visitor, and still breeds in Scotland. The adult male is a little less than two feet long; the plumage on the under-surface is yellowish-white, as it is on the head, where it is marked with brown, the colour of the rest of the upper surface. These birds feed principally on fish.

Osseti, a people of Caucasia, where they occupy both slopes of the central range between Lezghistan and Imeritia, east and west, and from Kabardia southwards nearly to Tiflis; three main divisions, *Iron*, *Digor*, and *Tuall*, speaking three distinct dialects of a rude Aryan language, showing decided structural affinities to the old Iranian (Persian). Under each division are a large number of tribes of very mixed origin, as shown by the great diversity of types (Iranian, Georgian, Kabard, Mongol, and even Semitic), with total population from 110,000 to 120,000. The *Iron*, i.e. *Iran*, are probably of Iranian descent, while the others have been traced to the Aryan Alans, some of whom settled in North Caucasia at a remote epoch. These appear to be the *Assy* (*Iassy*) of the Russian chronicles, whence the general name, *Ass*, *Oss*, *Osseti*, applied to the whole people by the Georgians. During the historic period the Osseti have been twice Christians and twice Mohammedans, and at present about twenty per cent. are Moslem, the rest nominal Christians, still practising many old superstitious rites. Field operations are left to the women, while the men ply various crafts, such as saddlery, tanning, forging, besides hunting and, till lately, brigandage. The vendetta is still observed in its full vigour, despite the efforts of the Russian authorities to suppress a custom which leads to constant bloodshed. (Klaproth, Schifner, Pfaff, Kokief, Miller.)

Ossian, an heroic poet of the Gaelic tribes, is said to have been the son of Fionn, who lived in the third century A.D., and his works consist chiefly of accounts of the doings of Fionn and his family. Ossian himself is said to have been carried off when young to fairyland, and, on his return in old age and blindness, to have recounted the legends to St. Patrick. Originally fragmentary, the Ossianic poems have become a generic term for ancient Gaelic literature, whether of Scottish or Irish origin. They possess little interest now, but in the eighteenth century excited a warm controversy, when (in 1760 and the following years) James Macpherson published the two epics *Fingal* and *Femora*, and shorter poems, which professed to be translations of Ossian. Macpherson was not a Gaelic scholar, and there seems much room for doubt how far the poems were not his own composition. Scott, in the *Antiquary*, bestows some good-humoured satire upon the question.

Ossification is the term applied to the process by which, in the course of development, true bone is deposited and takes the place of the more rudimentary structures which represent this tissue in the embryo or growing child. Ossification is of two kinds: in the first place, there is what is called *ossification in membrane*, such as occurs, for example, in the flat bones of the skull, which are

developed from membranous structures; in the second place, there is *ossification in cartilage*, such as occurs in the case of the long bones, the representatives of which in the embryonic condition are rods of cartilage. The changes which the cartilaginous rod undergoes in the process of conversion into bone are somewhat complicated. They commence at definite points, which are termed *centres of ossification*. Here the cartilage becomes permeated by minute blood-vessels, and its substance is impregnated with lime-salts, *i.e.* calcified. The calcified cartilage is later reabsorbed, and a framework of spongy bone laid down in the ossifying tissue. This spongy bone becomes in its turn absorbed and replaced by compact bone. The centres of ossification are the points at which the most active changes are manifested. Such centres are usually found near the ends of long bones, and the increase of these bones in length is consequent upon the continued advance in the process of ossification at such centres. The bone increases in thickness by the formation of new bone beneath the fibrous investing layer of the bone called the periosteum.

Ossington, JOHN EVELYN DENISON, LORD (1800–1873), entered Parliament in 1823, and in 1857 was made Speaker of the House of Commons, in succession to Sir J. Shaw-Lefevre. He held this post until 1872, when he was raised to the peerage.

Ossyebos, a people of west Equatorial Africa, who occupy the left bank of the Ogoway, where they are conterminous with the Adumas. The Ossyebos are a fine race of modified Negro type, speaking a Bantu language, related to the Mpongwe of the Gaboon district. They are not to be confounded with the Osyebas, who form a main division of the Fans (q.v.).

Ostade, ADRIAN VAN (1610–85), Flemish painter, was born at Lübeck, and studied under Francis Hals. His works depict smoking, quarrelling, drinking, and other features of peasant life. ISAAC (1612–71), brother of Adrian, took him as a model, and was employed by landscape-painters to add figures to their pictures.

Ostend, a Belgian town of west Flanders, is the chief Belgian port of entry for passenger traffic from Dover to and through Belgium, and is also very important as a bathing-place and summer resort. The coast and neighbourhood are sandy, and the long sea-wall is utilised as a promenade. Among the chief buildings are the Hôtel de Ville, the King's Pavilion, and the Kursaal. Fishing for cod and herring is carried on, and there is a noted park of oysters, which are brought from the English coast to be here fattened. The fortifications, which were formed by the Prince of Orange in 1585, have given place to boulevards. In 1601–4, Ostend underwent a siege during the struggle with Spain.

Ostia, anciently the port of Rome, from which it is six miles distant, was believed to have been founded by Ancus Martius, who also established salt-works here. Originally a trading port, it became in the Punic Wars a naval station, and its

inhabitants were exempt from military service. Owing to the silting up of the lower Tiber, the Emperor Claudius caused a new harbour—which received the name “Portus”—to be constructed, and connected it with Rome by a canal. This soon rivalled Ostia, which gradually decayed, and was finally destroyed by the Saracens in the ninth century. Both places are now in ruins.

Ostracism, a form of banishment introduced into Athens by Cleisthenes (q.v.). Its object was to prevent any citizen who was conspicuous through his ability, riches, or popularity from acquiring too great power in the state. When the people had decided that an ostracism was necessary, a public meeting (*eccllesia*) was held in the market-place (*agora*), and the citizens voted by tribes, each depositing in a fixed spot an oyster-shell (*ostrakon*) on which was written the name of the person whose banishment he desired. The citizen who obtained the largest number of these unfavourable votes was forced to leave Athens for ten years. A similar institution, “petalism,” existed in Syracuse.

Ostracoda, an order of Crustacea, belonging to the sub-class Entomostraca (q.v.). The members of the order are all small, but a few deep-sea marine species are nearly an inch in length. The body is not divided into segments; the abdomen is rudimentary, and there are seven pairs of appendages, but these are not adapted for swimming. The body is protected by a bivalve shell. The members are all aquatic, and occur in either the sea or fresh-water; they swarm in great numbers, and their dead shells often render fresh-water clays easily fissile. The order is widely distributed, and fossil species are known from the Cambrian onwards. *Cypris* is one of the commonest genera; it is fresh-water. *Cythere* is one of the commonest marine forms. There are seven families.

Ostreidæ, the family of Mollusca (q.v.), of the class Lamellibranchiata (q.v.), of which the common oyster (*Ostrea edulis*, Linn.) is the type. The two other principal members are the genera *Anomia* and *Placuna*. The family ranges from the Carboniferous period onward. It is typically marine, but some specimens live in only slightly brackish water.

Ostrich, any bird of the Ratite genus *Struthio*, with two species, from Africa and Arabia. The head, neck, and thighs are naked; the tarsi are covered with scales; there are only two toes; and the quill-feathers of the wings and tail—the ostrich plumes of commerce—have their barbs quite free. Ostriches are the largest living birds, standing from six to eight feet high. The rudimentary wings are useless for flight, but these birds run with great speed, and then their wings are spread out and act as sails, helping them along. There is not a great deal of difference between the two species. *S. camelus*, the common form, has the widest range, and in these birds the naked skin is red, while in *S. molybdophanes*, from Somaliland, it is bluish, and there is a red plaque in front of the tarsus. Ostriches are principally vegetable feeders, and wild birds do considerable damage to corn crops.

Extraordinary stories have been told of the powers of digestion of these birds, probably arising from the fact that when at liberty they swallow stones to aid the gizzard in its work, and in confinement gulp down readily whatever may be offered. The large eggs are well-known objects in this country. In bulk they are equal to twenty-four hen's eggs, and are excellent eating. Authorities differ as to the quality of the flesh of these birds. That of the young is generally allowed to be very good, while that of old birds is said to require the sharp sauce of hunger to render it palatable. Ostriches are polygamous, each male living in company with several females, which deposit their eggs in a common nest—if a hole in the sand can be so called. The male takes part in incubation, generally sitting at night. These birds have been known from remote antiquity. They are mentioned in the Hebrew Scriptures and in the classics. It was formerly the custom to hunt the ostrich on horseback for its plumes, and the natives of South Africa stalk it, clothing themselves in ostrich skins, so as to get near the birds without exciting alarm, and shooting them with poisoned arrows; but since 1867 the market for ostrich plumes has been almost entirely supplied with those taken from domesticated birds. The wing plumes are more highly prized than those of the tail, and the yield from the male bird is much more valuable than that of his mate. The French have established ostrich-farms in the north of the continent, and birds have been introduced into Australia and America for the same purpose.

Ostyaks. (1) *Ostyaks of the Obi*, a historical people of West Siberia, who before the Russian invasion (1501) were very powerful, possessing numerous fortified towns and a well-developed national organisation. They are now reduced to a number of small groups scattered over a space of about 400,000 square miles, chiefly in the Obi basin, but numbering altogether scarcely more than 26,000 in 1880. They call themselves *Manzi*, "men," Ostyak being a Tatar word (*Ushtiak*) meaning "strangers," unless it be a corruption of *As-yak*, "people of the *As*," i.e. the Obi river. The Ostyaks form one of the three main divisions of the Ugrian Finns, their language, of which there are three marked dialects (Irkutsk, Surgut, and Obdorsk), being most nearly related to that of the Voguls of the Ural Mountains. (2) *Ostyaks of the Yenisei*, Siberian aborigines of the Upper Yenisei basin as far as the confluence of the lower Tunguska, usually classed as Samoyedes; but the language, of which there are several varieties (Assan, Arinzi, Kotti, etc.), appears to be quite distinct. It is highly agglutinating, and has been compared with the Basque of the western Pyrenees, with which, however, it has no structural resemblance.

Oswald, St. (604–42), King of the Northumbrians, was the son of Ethelfrith, after whose death in battle in 617 he took refuge among the northern Celts, who are said to have converted him. In 633 he returned to Northumbria, and two years after made himself master of Deira and Bernicia by a victory which he commemorated by constructing

a cross. He christianised his people, and was killed in battle at Oswestry, becoming afterwards one of the most popular of north-country saints.

Oswego. [MAIZE.]

Oswego, a city and port of the United States of America, in Oswego county, New York, is situated on both banks of the Oswego at the point where the river falls into Lake Ontario. It is well built, with wide streets, good houses, and some fine buildings. There is a great transit trade from New York and Canada to the west, and the plentiful water-power is utilised for saw- and flour-mills. Iron-founding, ship-building, machine-making, and tanning are also carried on.

Otago, a New Zealand province at the southern part of the South Island, having 25,487 square miles of area and 400 miles of coast-line, and surrounded by the ocean on three sides. On the E. and S. are the harbours of Otago, Bluff, and others, and there are long inlets on the W. The western part and the centre of the province are mountainous, the height ranging from three to nine thousand feet, and the upland pastures are excellent for sheep. The E. and S. are fertile, and produce much wheat. The Clyde, the largest river in New Zealand, flows S.E., and drains the lakes Hawea, Wanaka, and Wakatingue. There are other extensive lakes. The chief natural productions are timber, flax, gold, and coal. The capital, Dunedin, inaccessible to large vessels, is at the head of Otago harbour. The colony, of Scottish origin, was founded in 1848.

Otalgia, pain in the ear, or ear-ache, may be due to some disease affecting the external passage of the ear, or to inflammation of the middle or internal ear. In some instances it seems to be associated with caries of a tooth.

Othman, founder of the Ottoman Empire, was born in Bithynia in 1259. In 1299 he possessed himself of part of Bithynia, and subsequently of great part of Asia Minor. From him the Turks take their name of Osmanli.

Otho. 1. MARCUS SALVIUS, Roman Emperor (32–69), was a friend of Nero and a companion of his debauchery. Otho is said to have bought the proconsulship of Lusitania, which he held for some time, with his wife, Poppæa Sabina, whom he introduced to Nero's notice. In 67 he declared for Galba against Nero, and he helped to murder Galba in 69, becoming himself emperor. He did not reign long, since the army in Germany sided with Vitellius, and after some reverses finally defeated the forces of Otho, who then committed suicide.

2. OTHO (OTTO), commonly called "the Great" (912–973), was the son of Henry I., on whose death in 936 he was elected King of Germany. His life was largely taken up with wars, the first of these being a war of 14 years against Boleslas of Bohemia, whom he compelled to embrace Christianity. He then defeated the Dukes of Bavaria and Franconia, and repulsed the Danes. In 931 he aided the Italians against the usurper Berengar II., and was crowned King of Lombardy. He was next beset by family revolts, which he

repressed, and, after overcoming the Hungarians, reappeared in Italy, of which he was crowned king in 961, being crowned Roman Emperor by the Pope in 962. His later years were employed in worsting the Greek Emperor, who had refused to acknowledge his title.

Otis, JAMES (1724-83), was born at Barnstable, in Massachusetts. In 1743 he graduated at Harvard, and applied himself to the law. He entered keenly into the questions that arose between the colonies and the home country, and in a dispute about the Navigation Laws he threw up his appointment as law-officer of the Crown, and pleaded the cause of the colonists before the High Court with such force and eloquence that he became a man of mark, and was chosen to represent Boston in the colonial Assembly. He wrote many papers to the colonists, and, on their behalf, to the home Government, and became the recognised chief of the revolutionary party. In 1769 he was attacked in a coffee-house, and received such injuries to his head as brought on insanity.

Otitis, inflammation of the middle ear, is accompanied by pain and increased redness of the membrana tympani. It may be due to catching cold; the severer forms resulting in the formation of pus in the cavity of the middle ear, with perforation of the drum of the ear, and discharge of matter externally, usually occur in children after an attack of measles, scarlet fever, or other disease. A simple catarrh may yield to warm fomentations and mild purgation; but ear-ache involves so many possible serious complications that it is advisable to procure medical advice from the outset. The discharge of pus from the ear (*otorrhœa*) is apt, if neglected, to persist for a long time, and in some cases has resulted in septic mischief or cerebral abscess.

Otomaks, aborigines of Venezuela, whose territory comprises the section of the middle Orinoco between the Apure and Meta confluences. During low water they live on fish and turtles, but during the great floods, when fishing is impossible, they consume large quantities of a fatty earth, a kind of potter's clay, which is collected on the banks of the rivers and stored in their huts. This diet, varied with a few frogs, lizards, and fern-fronds, appears to be in no way injurious, and even in the fishing season some of the earth is taken as a "dessert" after meals. The Otomaks have coarse Mongolic features and a deep coppery colour, being with their Guamo neighbours almost the darkest people of all the American aborigines.

Otomi, a primitive people of the Mexican tableland, where they occupy the slopes of the mountains north of the valley of Mexico and thence nearly to the Rio Verde in the state of San Luis Potosi; they are amongst the rudest populations of Mexico, so much so that their very name has become a by-word for all that is uncouth, gross, and brutish amongst the surrounding tribes. At the time of the conquest (1520) most of them were still mere savages of a very low type, and none had formed any kind of social organisation before the

15th century; but they are specially remarkable for their *Hia-hua* language, as it is called, which is the only monosyllabic form of speech in the New World, and which is also of exceedingly harsh and difficult utterance. The Otomi group comprises, besides the Otomi proper, the *Serranos* of the Sierra Gorda in Guanajuato; the *Mazahuas* in the Tajimaroa and Zitacuaro Mountains; the *Pames* in San Luis Potosi and neighbouring provinces, and the *Jonas* (*Mecos*) in Guanajuato; total population of Otomi speech, about 650,000.

Otranto, an Italian town in the modern province of Lecce, is on the Strait of Otranto, 42 miles S.E. of Brindisi. There is a large and convenient harbour, and a considerable trade is carried on with the Levant. The city (which has an old cathedral, some Roman remains, and the castle made famous by Walpole), is poorly built and decaying. The province, which contains 2,880 square miles, is surrounded by the sea except to the W. and N.W., and has several bays and harbours. A branch of the Apennines passes through it, and there is good pasture-land. The chief productions are cotton, fruit, grain, oil, and tobacco.

Ottawa. A river of Canada, separating the provinces of Quebec and Ontario. It takes its rise in a lake in the high land between the St. Lawrence and Hudson Bay, and, after a course of 300 miles N.E. to S.W., flows S.E. for 400 miles, forming on the way the Lake of Two Mountains, and falls into the St. Lawrence at St. Anne's Rapids, which begin six miles above Ottawa city, and have a drop of forty feet at Chaudière Falls. The river is navigable to these falls, and the rapids are passed by means of the Rideau Canal.

The city, the capital of Canada, is in the province of Ontario, on the right bank of the river Ottawa, 100 miles west of Montreal. It is on the Canadian Pacific Railway, and is divided into Upper and Lower town by the Rideau Canal, which is crossed by a stone bridge. The city is well built and laid out, and has fine Government buildings which cover four acres, and the first stone of which was laid by the Prince of Wales in 1860. Rideau Hall in the neighbourhood is the residence of the Governor-General. There is a considerable lumber trade, and some manufactures. The town used to be called Bytown, after Colonel By, who founded it in 1827. The name was changed in 1854, and Ottawa became capital of Canada in 1858.

Ottawa (OTTOWAY), the name of several groups of North American Indians, all of whom belong to the Algonquian family, the most important being the Canadian Ottawas, about 3,550, scattered over an area of 40,000 square miles in the basin of the Ottawa river, named from them, and on the eastern slopes draining to Hudson Bay. Most of these are Roman Catholics of French speech; the Ottawas of Michigan, now grouped with the Chippewas in the Mackinac Agency, Michigan, where they jointly numbered about 3,700 in 1890; Lake Erie Ottawas, of whom 137 are now in the Quapaw Agency, Indian Territory, and others with the Ojibwas in Manitoulin and Cockburn Islands, Ontario, where they collectively numbered 928 in 1890.

Otter, any individual of the aquatic sub-family Lutrinae of the weasel family (Mustelidae). The body is long and low, with short limbs and short round feet (except in the sea-otter, which has the hind feet fin-like), the toes webbed and armed with curved blunt claws. The type-genus (*Lutra*), with numerous species, is widely distributed. The common otter (*L. vulgaris*) is British. There is great variation in size, but large specimens may reach a length of forty inches, or a little more, of which the tail counts for about a third. It swims and dives well, and subsists principally on fish. It is rarely met with far from water, and makes a nest in a bank or among the roots of a tree overhanging the water. In the East otters are trained to catch fish for their masters, and the fur of all the species is of commercial value. The margin-tailed otter (*L. brasiliensis*) is sometimes made a distinct genus (*Pteronura sambachi*), on account of the ridge on each side of the tail. The sea-otter (*Latax*, or *Enhydris lutris*), from the north Pacific, is larger and more stoutly built than the English otter. It feeds on molluscs and crustaceans, and its fur is even more valuable than that of the seal.

Otterburn, a border fight which took place in 1388 between the adherents of Percy and Douglas. It is commemorated in the ballad of Chevy Chase.

Otter Sheep. [ANCON SHEEP.]

Otto of Roses. [ATTAR OF ROSES.]

Otway, THOMAS (1651-85), an English tragedian, was born in Sussex, where his father was Rector of Woolbeding. He was educated at Winchester and Oxford, and came to London to try his fortune as an actor. Here he met with failure, and turned his attention to play-writing. In 1675 appeared *Alcibiades*, and in 1676 his *Don Carlos* proved a success. The Earl of Plymouth, son of Charles II., patronised him, and obtained him a commission as cornet. He went to Flanders, but soon returned to poverty in England, and again wrote for the stage. Besides adapting from Racine and Molière, he produced in 1680 *The Orphan* and in 1682 *Venice Preserved*, these being the pieces on which his reputation chiefly rests. He also wrote comedies, which share the coarseness and libertinism of the age. His writing is forcible and sympathetic. He died in poverty.

Oudenarde, a Belgian town of east Flanders, is on the Scheldt, fifteen miles south of Ghent. It has a sixteenth-century Hôtel de Ville, with fine tower, and some good churches. Linen and cotton goods are manufactured. The town has several times been besieged, and was the scene in 1708 of a battle in which Marlborough and Prince Eugène defeated the French.

Oudh is a province of British India, having Nepal on the north and the Ganges as part of its south boundary. It contains upwards of 24,000 square miles, and is, for the most part, level and fertile, being watered by the Ghogra, Gumti, and other tributaries of the Ganges. The chief productions are wheat, barley, rice, sugar, indigo, nitre, and other salts. Much of the surface is covered

with jungle. Among the inhabitants are many Rajputs and Mussulmans. Once a Mogul province, Oudh became subordinate to England in 1765, was annexed in 1856, becoming a hot-bed of rebellion the next year. The town of Oudh, on the Ghogra, was once the capital, and is much venerated by the Hindus. The present capital is Lucknow.

Oudinot, CHARLES NICHOLAS (1767-1847), a French general, entered the military service for a time, and then after retirement returned to it as commander of Volunteers in 1791. He soon distinguished himself, and was general of division in 1799. He was in favour with Massena, and did good service in Italy, especially at the battle of Mincio. Later Napoleon put him in command of his advance guard, and he again distinguished himself in the campaign against Austria and Prussia, especially at Wagram, being made Marshal of France and Duke of Reggio in reward. He led the retreat from Moscow. After this he retired, but returned to the service in 1814. At Napoleon's fall he joined the Royalists, and was made peer of France. In 1842 he was appointed Governor of the Hôtel des Invalides, retaining the post till death. His son (1791-1863) was a general in the French army.

Ouida, the name under which the novelist LOUISE DE LA RAMÉE publishes her works. She was born in London in 1840, but has spent much of her life in Florence. As early as 1861 she wrote for magazines. Among the best known of her novels are *Under Two Flags* and *Moths*.

Oules, WALTER, English portrait-painter, was born at St. Heliers in 1848. He came to London in 1864, and began to exhibit at the Academy in 1868. He became A.R.A. in 1877, and R.A. in 1881. He has painted many successful portraits, among them being those of Darwin and Cardinal Newman.

Ounce. *Ounce* and *Inch* are doublets, both being derived from the Latin *Uncia*, the twelfth part of any weight or measure. An ounce is the twelfth part of a pound troy, but the sixteenth part of a pound avoirdupois. In the former it contains 480 grains (20 dwt.), in the latter 437½ grains.

Ounce (*Felis uncia*), the Snow Leopard, from the mountains of central Asia.

Ourari. [CURARI.]

Ouse. 1. THE YORKSHIRE OUSE is formed by the junction of the Swale with the Ure. It flows south-east, past York, Selby, and Goole, and 8 miles east of Goole unites with the Trent to form the Humber. It receives the Wharfe and Aire from the west, the Don from the south, and the Derwent from the north.

2. THE GREAT OUSE rises in Northampton, and flows north-east through Buckingham, Bedfordshire, Huntingdonshire, Cambridge, Norfolk, and falls into the Wash at King's Lynn. For two-thirds of its course of 160 miles it is navigable. Its tributaries are the Ivel, Cam, Larke, Little Ouse, and Stoke.

Ouseley, SIR FREDERICK (1825-89), an English musician, succeeded his father in the baronetcy at the age of 19. He was educated at Christ

Church, Oxford, and, having taken orders, became curate of St. Paul's, Knightsbridge. In 1855 he was appointed professor of music at Oxford, and in 1856 vicar of St. Michael's, Tenbury. He had a wonderful knowledge of music, was a composer, and was a good linguist. He founded and endowed the college of St. Michael, Tenbury, for the education of choristers. He edited *Naumann's History of Music*, wrote a *Treatise on Harmony*, and the oratorios *St. Polycarp* and *Hagar*.

Oustitis. [MARMOSSET.]

Outcrop, or BASSET EDGE, the exposure of a rock at the surface. The width of the outcrop depends both on the dip or variation from horizontality and on the thickness of a stratum. Its general direction on the map is termed the *strike* (q.v.). The outcrop of soft rocks will often be flat, whilst that of relatively harder ones may stand up as an *escarpment*.

Outram, JAMES, LIEUTENANT-GENERAL SIR (1803-63), was born in Derbyshire, and educated at Aberdeen. In 1819 he went to India as a cadet. In 1828 he subdued, and then trained to discipline the Bheels. In 1838 he took part in the Afghan War, and was present at the capture of Khelat, and in 1840 made a daring ride in disguise through the enemy's country. After distinguishing himself in several posts both military and civil, during which time he came into collision with Napier, who gave him the title of "Bayard of India," he went to Persia, and finished his campaign in three months. During the Indian Mutiny he went with Sir Colin Campbell to the relief of Lucknow, and here showed his nobleness of character by waiving his rank and fighting under Havelock. For his services he was made baronet, G.C.B., and lieutenant-general; the state of his health prevented further active service.

Ouzel, OUSEL (literally "a bird," from Old French *oiseil*), the blackbird (q.v.). [DIPPER, RING-OUZEL.]

Ovambo (OVAMPO), a large Bantu nation of south-west Africa, who give their name to the region (Ovamboland) which stretches from the Cunene river southwards to Damaraland. The Ovambo, *i.e.* "Settled People," are so called by their Damara (Herero) neighbours because all are agriculturists, living in fixed settlements about the lagoons and watercourses south of the Cunene. They have themselves no collective national name, but form twelve distinct and mostly hostile groups, of which the most powerful are the Ondongas, who claim a sort of over-lordship over all the rest. It was the Ondonga chief who in 1884 sold a vast tract of land south of Lake Etosha to the "Afrikander" Jordan, founder of the ephemeral Boer republic of Upingtonia. By the Treaty of Lisbon of 1886 the Ovambo territory was divided into two sections, the northern being annexed to the Portuguese colony of Angola, the southern to the German protectorate of south-west Africa. The Ovambos, who are a fine race, tall, robust and well-proportioned with Negroid features, speak several marked dialects of a Bantu language closely related to that

of their Ova-Herero neighbours. (Galton, Palgrave, Schinz, Von François.)

Ovary. The ovaries in the human female subject are two oval bodies which lie on either side of the uterus, enclosed in the broad ligament of that organ. Each ovary measures about an inch and a half by three-quarters of an inch, and is nearly half an inch in thickness; it is attached by what is called the ligament of the ovary to the uterus, and is also attached to the Fallopian tube, which receives the ovum discharged from the ovary at the time of ovulation (*i.e.* at or about the period of menstruation), and transmits it to the uterus. The ovum is enveloped by a dense capsule (tunica albuginea), and is composed of a peculiar connective tissue stroma with interspersed follicles, the *Graafian vesicles*. In each of these vesicles there is developed an ovum, and when the vesicle matures it increases in size, its periphery approximates to the surface of the ovary, and rupture of the vesicle ultimately occurs with discharge of the contained ovum. *Diseases of the ovary.* The ovary is sometimes affected by inflammation, and may be the seat of a new growth. The huge cysts which develop in connection with the ovary, and which if left to pursue their natural course attain a very great size, have in recent years been successfully treated by operation. At one time the merely palliative method of tapping such ovarian cysts was resorted to; in the first half of the present century removal of the cyst was attempted in several instances, but the results were not very encouraging, there being a large percentage of deaths. Modern operators have, however, demonstrated that *ovariotomy*, as it is called, is a procedure which in competent hands is only attended with a very small degree of risk to life, and they have thus rendered amenable to treatment what was in former days a horrible and usually fatal disease.

Oven. The kind of oven which is still mainly used by bakers is a low reverberatory chamber with an arched roof. The sole or floor of the oven is commonly of stone. The dough is inserted through a door in the face with a long wooden spade, termed a "peel." Such an oven may be heated either externally by means of a furnace at the front corners—the products of combustion passing through an opening into the oven—or internally, a fire being lighted within it, or a "chaffer" being moved about in the inside. In the latter case wood is the best fuel, but when the furnace is heated from without it is usual to employ coal. Many improvements have recently been introduced in the construction of ovens. Thus it is common now to have a furnace underneath the sole, with flues arranged round the oven, into which the gases from the furnace enter. If it is desired to heat the oven internally as well as externally, the gases can be admitted into it through openings worked with valves or dampers.

Oven-Bird, a name for any bird of the South American Passerine genus *Furnarius*, from their dome-shaped nests, with the entrance at the side. The name is less properly applied to the willow-wren.

Overbeck, FRIEDRICH (1789–1869), a German painter, was born at Lübeck. He went to Vienna in 1806, and to Rome in 1810. Here, with his comrades, Cornelius and Schadow, he formed a new school in art, the principle of which was a return to the method of the old pre-Renaissance painters. In 1811 he painted a *Madonna*, and followed this up by frescoes of *Joseph Sold by his Brethren* and *Seven Years of Famine*. He confined himself to devotional subjects, and in 1814 joined the Roman Catholic Church. Other notable works of his are the *Entry of Christ into Jerusalem* and the *Influence of Christianity upon Art*, and five frescoes on subjects taken from the *Jerusalem Delivered*. He designed in charcoal and chalk, and his frescoes were better than his oil-paintings.

Overbury, SIR THOMAS (1581–1613), was born in Warwickshire and educated at Queen's College, Oxford. After going to the Temple for a time he went to Court, and was patronised by Robert Carr, who caused him to be knighted in 1608. When Carr (then Rochester) wished to marry the Countess of Essex, Overbury opposed the idea, and so incurred the enmity of Rochester and the Countess, who first tried to compass his death and then to get rid of him by appointing him to a foreign mission. Overbury declined this, and was committed to the Tower on a charge of disobedience to the king's wishes, and here he was poisoned at the instigation of Rochester and his wife. Both were condemned to death, but, though their instruments suffered death, the chief culprits were pardoned by James. Overbury was not without reputation as a writer.

Overlap, the extension of a bed of rock beyond the surface of that immediately underlying it on to a yet older stratum. It generally indicates an extension of the area of deposit owing to depression.

Overstone, SAMUEL J. L., BARON (1796–1883), financier, banker, and millionaire, was the son of Lewis Loyd. After his education at Eton and Trinity College, Cambridge, he entered his father's bank. From 1819 to 1826 he represented Hythe in Parliament, and in 1850 he was made a peer. He wrote tracts upon the Bank of England, and his tract upon the Currency Question had great influence upon the provisions of the Bank Charter Act of 1844. Lord Overstone was greatly opposed to the principle of limited liability.

Ovid, PUBLIUS OVIDIUS NASO (43 B.C.–18 A.D.), a well-known Latin poet, was of equestrian rank, and born at Sulmo. He studied rhetoric with a view to the bar; but, the death of an elder brother setting him free from this necessity, he went to Athens to study Greek, and then travelled in Asia Minor in company with another poet. On his return to Rome he filled some State offices, but his easy-going nature and love of pleasure left no room for ambition. He divorced two wives, and was credited with having Julia, daughter of Augustus, as a mistress. He married later a third wife, by whom he had a much-loved daughter. He lived at Rome till his fiftieth year, when, for some reason unknown, Augustus banished him to Tomi, near the

mouth of the Danube, where he died, but not till he had won the esteem of his new fellow-citizens. Of his works the best known are *Art of Love*, the *Metamorphoses*, the *Fasti*, and some shorter poems.

Oviedo, a town of Spain, in the province of Oviedo, in the Asturias, 230 miles north of Madrid. It is a clean town, irregularly built, and contains some ancient churches, a university, a court-house, hospital, etc. Hats and arms are manufactured. The province of Oviedo, 4,080 square miles in area, is on the Bay of Biscay. The mountainous interior contains good pasture-land, and many cattle, goats, and swine are reared. Linens, woollens, and leather are manufactured, and coal mined.

Oviparous, laying eggs which are hatched outside the body of the parent. Most invertebrates, fishes, and reptiles, all birds, and the monotremes are oviparous. The term *ovoviviparous* is applied to those animals the eggs of which are hatched within the body of the parent, while *viviparous* is used of the marsupial and placental mammals and their gestation.

Ovule, the unfertilised seed (q.v.) in flowering plants. It may be naked, as in Gymnosperms (q.v.), or enclosed in an ovary, as in Angiosperms (q.v.); and may be solitary in each chamber of the ovary, or one of a number. The Compositæ and Gramineæ have but one ovule to each flower; the Ranunculaceæ and Umbelliferæ one to each carpel; and the Drupaceæ two, and the Cupuliferæ sometimes as many as six, only one, as a rule, becoming a seed. The ovule in the yew and the Polygonaceæ seems to be the apex of an axial or stem structure; in Ginkgo, the Compositæ, and the Primulaceæ it appears lateral, or homologous to a leaf; in the majority of plants it is undoubtedly a marginal leaf-structure, homologous to a lobe of the leaf; and in the poppies and water-lilies, where ovules are scattered over the surface of the carpel (q.v.), they are apparently the homologues of hairs. [PLACENTATION.] The ovule originates in a cellular papilla on the placenta, known as the *nucleus*, or preferably as the *nucellus* or *tereine*, which is carried up on a stalk or *funicle* and enclosed by one or two coats, the *sceundine* and *primine*. developed from its base or *chalaza*. These coats leave an opening at its apex, the *micropyle* (q.v.), through which the pollen-tube enters in fertilisation (q.v.), and the radicle makes its exit in germination (q.v.). The ovule may be *atropous*, *orthotropous*, or unbent, as in the Polygonaceæ, with a short funicle; but more commonly, as in Compositæ, Leguminosæ, Umbelliferæ, Cupuliferæ, and Liliaceæ, it is inverted or *anatropous*, owing to the rapid growth of the funicle, which adheres to the side of the ovule and is termed the *raphe*. In this way the micropyle is brought near to the placenta down which the pollen-tubes find their way. The same result is also, but less commonly, brought about, as in Cruciferæ and Malvaceæ, by the ovule becoming *campylotropous*, or entirely bent on itself, the funicle remaining short.

Ovulites, a genus of fossils which are minute in size; ovoid, cylindrical, or drumstick-like in

shape, and which occur in the lower Cainozoic (q.v.) rocks of France and the West Indies. They were originally described as Foraminifera, but the more recent view is that they are small calcareous algæ.

Ovum, the single cell from which a multicellular animal develops, usually after fertilisation by another cell which represents the male element. In the simpler animals the ovum is one of the cells of either of the two membranes (ectoderm and endoderm), forming the wall of the body, but in higher animals it is one of the cells of a special organ called the ovary. The ovum may be composed simply of protoplasm and a nucleus, or it may have one or more envelopes; it generally contains some food material (deuteroplasm) which may be mixed up with it or be included with the ovum in an egg-shell; it is then absorbed during the subdivision and growth of the ovum. Before fertilisation the ovum undergoes the process of karyokinesis (q.v.), when half of the nucleus is expelled; the remaining half may undergo the same process. The ovum is then quiescent until it is stimulated to development by union with a "spermatozoon" or male element; this, however, is not necessary in some cases, which may develop directly a process known as parthenogenesis (q.v.).

Owen, JOHN, D.D. (1616–83), a Calvinistic divine, was born in Oxfordshire, where his father was vicar of Stadham. He was educated at Oxford, and afterwards became tutor in Sir Robert Dormer's family and chaplain to Lord Lovelace. From Presbyterianism to Independent tenets was his next step, and he made the acquaintance of General Fairfax. He preached at Whitehall the day after King Charles's death, and he accompanied Cromwell to Ireland and Scotland. In 1651 Cromwell made him Dean of Christ Church, and Vice-Chancellor the next year, but he was deprived of both these offices in 1657. In 1658 he took part in the Savoy Conference. Among his writings are, *Exposition of the Epistle to the Hebrews*, *Discourse on the Holy Spirit*, and *Account of the Protestant Religion*.

Owen, RICHARD, SIR (1804–92), noted English naturalist and comparative anatomist, was born and educated at Lancaster, where he formed a friendship with Whewell, afterwards Master of Trinity, Cambridge. He then proceeded to Edinburgh, and later to St. Bartholomew's Hospital, where he obtained his diploma, and was the pupil of Abernethy, who was so struck by Owen's anatomical tastes as to cause his employment in cataloguing the Hunterian collection at the Royal College of Surgeons. Here Owen laboured till 1855, having married the daughter of his colleague in the work in 1835. From 1834–55 he lectured in comparative anatomy at St. Bartholomew's and the College of Surgeons. He had much to do with developing the Zoological Society, and sat on various Health Commissions, and had the duty of arranging the models of extinct animals for the Exhibition of 1851. In 1856 he was appointed head of the natural history department at the British Museum, and did not rest till he had brought about the removal of the department to

South Kensington, resigning his post in 1883, when the task of arrangement had been well-nigh completed. The Queen gave him Sheen House, where he passed many years of his later life. He was made K.C.B. in 1883, and many other distinctions, foreign and English, were bestowed upon him. His earliest paper, on *Calculus*, in 1826, was the prelude to a vast mass of literary work, mostly bearing upon the different branches of comparative anatomy. It may be sufficient to mention here his *History of British Fossil Reptiles*, *Parthenogenesis*, and his works upon extinct animals of New Zealand, Australia, and America. Though the Darwinian theory was opposed to some of his fundamental ideas, he always kept an open mind with regard to it.

Owen, ROBERT (1771–1858), Socialist philosopher, was born in Montgomeryshire, and entered young into a Liverpool merchant's office. At 18 he was managing a mill at Chorlton and then a cotton-mill at New Lanark, where he married the owner's daughter. In 1814 the business became a company of which he was managing director, other members being W. Allen, Joseph Fox, and Jeremy Bentham. It was managed on Socialistic ideas, all profits above five per cent. going to the benefit of the work-people or the community at large. In 1812 he published a *New View of Society* and *Book of the New Moral World*, and travelled in Great Britain and America to inculcate his ideas. Among them was a plan for exchanging all products by means of a paper currency of labour notes, goods being valued in terms of the labour it took to produce them. This had a partial trial, but he alienated support by his secularist views. He saw his communities tried and found a failure in America, Scotland, and England. In later times he adopted spiritualism.

Owens College, Manchester, was founded by John Owens, a cotton-spinner of Manchester, who in 1846 bequeathed a sum of nearly £100,000 to establish a college of non-sectarian character. The original college, erected in 1851, was replaced by new buildings in 1873. The endowment having been raised to more than £260,000 by the gifts of Charles Clifton (1874), Charles Beyer (1876), and others, the college was in 1880 combined with others into the Victoria University. The various colleges composing this University—Owens College, the Yorkshire College, Leeds, University College, Liverpool, and the Manchester and Salford College for Women—are intended, in spite of their distance apart, to occupy the same position and discharge the same functions in its scheme as the Oxford and Cambridge colleges do in that of the ancient universities. The number of such colleges will be increased as opportunity occurs. A prescribed course of study in one of them is necessary to obtain a degree. Degrees are conferred in arts, science, law, and medicine. Women are admitted on the same terms as men.

Owl, any bird of the Raptorial family Strigidae, often termed nocturnal birds of prey, though some few are as diurnal in habit as other members of the order. Owls are universally distributed. They vary greatly in size, the smallest being only a

few inches in length, while the Eagle Owls reach, and sometimes exceed, two feet; and the females are generally larger than their mates. The head is large and broad, and the face short; the eyes are large and look directly forward, and are surrounded by a concave disc of feathers, best developed in the nocturnal forms, that serves to concentrate the rays of light. The bill is hooked, but has no "teeth"; and the nostrils do not open in the cere, as in the diurnal birds of prey, but at its border. The sense of hearing is acute, and the ear has an external opening, sometimes covered with a fold of skin. These openings are about on a level with the eyes, and below the plumicorns or feather-tufts of the Eared or Horned Owls, with which there is no connection. The legs are short and feathered to, and sometimes over, the toes, which are four in number, and armed with strong claws. The outer toe is reversible, so that the foot in some degree resembles that of Climbing Birds. Owls are exclusively animal feeders, and prey on small mammals, birds, reptiles, amphibians and fishes, and beetles and other insects. Many classifications have been suggested. That generally adopted divides these birds into an Alucine (= the Strigidæ of Sharpe) and a Strigine (= the Bubonidæ of Sharpe) section with the Barn Owl (q.v.) and the Wood Owl (q.v.) (both British) as the respective types. The Eared Owls belong to the genus *Asio*, which has two British species—the Long-eared Owl (*A. otus*), which carries the plumicorns erect, and the Short-eared Owl (*A. accipitrinus*), which generally has them depressed, though they are erectile at will. This species is often called the Woodcock Owl, because the two birds often arrive about the same time. The Eagle Owls belong to the genus *Bubo*, and contain the largest forms. The Great Eagle Owl (*B. maximus*) is a rare British visitor. The Hawk Owls form the genus *Surnia*, the species of which are more or less diurnal. The Snowy Owl (*Nyctea scandiaca*), an Arctic form, having white plumage marked with brown, is a rare visitor, as is also *Scops giu*, which was probably the bird of Athene. The Burrowing Owls of the genus *Athene* or *Speotyto* are American. [BARN-OWL, WOOD-OWL.]

Ox. [CATTLE.]

Oxalic Acid, $C_2H_2O_4$, occurs in many plants, usually in combination with potash—*e.g.* in wood sorrel, rhubarb, etc. Its lime salt also forms the chief constituent of urinary calculi. It may be obtained from the plant sources or prepared synthetically by numerous interesting and significant reactions. Its commercial manufacture is, however, effected by heating in shallow trays sawdust with potash or a mixture of potash and soda, lime being frequently added. The exact details of the production are kept closely as trade secrets. By the reaction salts of oxalic acid are formed which are converted to the calcium salt by the addition of lime. From this the acid is then liberated by means of sulphuric acid. It crystallises with water to form monoclinic crystals of specific gravity 1.64 easily soluble in water, the solution forming a strong reducing agent. It is a powerful poison. Commercially it is largely employed in dyeing and

calico-printing, in the manufacture of inks, dyes, and other chemical products, while its salts also find numerous applications. The potassium salt is known as *salts of lemon*. It is used for removing ink-stains, and is also very largely employed in photography.

Oxenstierna, AXEL, COUNT (1583–1654), a Swedish statesman, studied theology at Wittenberg and Jena, and then visited different German courts. In 1606 he was sent on a mission to Mecklenburg, and in 1608 became senator. He was at the head of the regency till the accession of Gustavus Adolphus, when he became Chancellor. In 1614 he accompanied the king to Germany, and was made governor-general of the conquered provinces, with headquarters at Mainz. After the reverses of Gustavus Adolphus, Oxenstierna summoned a congress at Heilbronn, and was the acknowledged chief of the Protestant League. In 1636 he was Chancellor in Sweden, and aided Queen Christina in many ways, until her determination to abdicate drove him from public affairs.

Oxford, the county town of Oxfordshire, is situated at the confluence of the Thames (Isis) and Cherwell, and on the borders of Berkshire. It is a "county borough" and seat of a Bishop and returns one member to Parliament, formerly two. Founded, probably, in the first quarter of the 10th century, it soon became important as a market and a place of pilgrimage. Its strategic importance was conspicuous in the struggle between Matilda and Stephen (1142), and in the Civil Wars when it was Charles I.'s headquarters and the seat of his Parliament. In the Middle Ages, too, Parliaments frequently met there. Latimer and Ridley were burnt there in 1555 and Cranmer in 1556.

Oxford Clay, a rock belonging to the Middle Oolite or lower part of the Upper Jurassic, generally dark-blue, containing some lime, much pyrites and selenite, and many septaria (q.v.). is from 300 to 600 feet thick, and extends across England from Weymouth, through the Vale of Blackmore, to Chippenham, Oxford, Huntingdonshire, and under the Fens to Hackness and Scarborough. It was also found in the sub-Wealden boring near Battle, in Sussex, from 950 to nearly 2,000 feet below the surface. It is often worked for brick-making. Besides ichthyosaurs and plesiosaurs, the most characteristic fossils are the bivalves *Gryphæa dilatata* and *Trigonia elavellata*, and the cephalopods *Belemnites hastatus* and *Ammonites Elizabethæ*.

Oxfordshire, an inland county of England, having Northamptonshire and Warwickshire on the N., Gloucestershire on the W., Berkshire on the S., and Buckinghamshire on the E. Of its 470,000 acres the greater part is arable, pasture, or meadow. In the south are hills and dales, the Chiltern Hills with their woods and downs being among them, and the county generally is well-wooded. The sloping land in the west is very fertile, the chief productions being wheat, barley, oats, turnips, and dairy produce. There are few manufactures, though Witney produces blankets, Woodstock gloves, Chipping Norton tweeds, and Banbury

velvet. The chief rivers are the Isis, Thame, Evenlode, Cherwell, and Windrush. The county returns three members to Parliament.

Oxford University. This is a Corporate Society numbering upwards of 12,000 members. Its foundation was formerly attributed on the strength of legal and literary forgeries to King Alfred; but its origin is now assigned to the growth in the flourishing and centrally-situated market-town of Oxford of a kind of guild formed by teachers and pupils, who were patronised by the monks of St. Frideswyde's, and by Henry I., who built Beaumont Palace in 1130. Eminent teachers, such as Thibaut d'Estampes, are known to have lectured there about 1120-30; and by 1187 the *Masters of Oxford*, who were mainly *secular clerks*, were organised in *Faculties*, and probably imitated such places of higher education or *general studies* as Bologna and Paris, to describe which the term *University* (*corporation aggregate*) was soon appropriated. The licence to teach which was granted by the acting full-members or *Regent Masters* to the *Undergraduates* (who, after a preliminary apprenticeship to study, were called, like the aspirants to knighthood, *Bachelors*) was the *Degree*; this was, and is still, conferred after a period of residence and prescribed and tested study in *Arts* (originally Logic, preceded by Latin, and followed by the Seven Arts of Grammar, Dialectic, Rhetoric, Music, Arithmetic, Geometry, and Astronomy, and the Three Philosophies of Physics, Metaphysics, and Ethics), and, usually after the Arts Course, in *Law*, *Divinity*, and *Medicine*: the degrees in the last three are those of the *Bachelor* (B.C.L., B.D., B.M.) and *Doctor* (D.C.L., D.D., D.M.); so also in the later faculty of Music (B.Mus., D.Mus.), for which residence is not required. The degrees of M.A., D.C.L., and D.D., are also conferred *honoris causâ*. The first Oxford M.A. whose name is recorded was the canonised Archbishop of Canterbury, Edmund Rich. The granting of degrees and the processes subsidiary thereto, teaching and examining, still form the most important function of the University. Undergraduates and Graduates of various classes are distinguished by difference of the academical *Gown*, the latter by varieties of *Hood* also.

To protect the scholars and promote the continuity of the society various privileges were granted by royal charters and papal bulls. The commissary of their diocesan, the Bishop of Lincoln, soon acquired an independent ecclesiastical authority under the title of *Chancellor*. Henry III., Edward III., and other kings, forced the citizens of Oxford not only to abstain from fleecing and molesting the students, but also, by way of compensation for outrages, to surrender the control of the Market and much of the civil government of the city. Royal interference also pacified internal feuds, which, as at the secession to Stamford, nearly produced disruption. The great intellectual progress made in the thirteenth century was due mainly to the settlement of the Friars (1221-24). The lectures of Bishop Grosseteste, of Adam Marsh, Duns Scotus, and Ockham (Franciscans), and of Holcot and Bradwardine (Dominicans), gave Oxford so great a

reputation in Europe that in the fourteenth century its influence surpassed that of Paris. The names of Roger Bacon, Wyclif, and Pecoock illustrate other intellectual developments. (See Mr. H. C. Maxwell-Lyte's *History of the University of Oxford*, and Professor T. E. Holland's article in *Oxford Historical Society's Collectanea* II.)

Oxford had begun to take an interest in the New Learning under Grocyn, Linacre, Colet, and Erasmus, when its prosperity was checked by the violent changes which accompanied the Reformation movement. Oxford men were among the earliest adherents of the new tendencies, as in the later revivals by the Non-Conformists (the early Quakers, the Wesleys, and Whitfield), and the Tractarians (Keble, Pusey, Newman). But the University, with most of the Colleges, survived, and in 1570 received from Parliament a full confirmation of all its privileges as conferred by Royal Letters Patent, with a formal Incorporation under the style of *The Chancellor Masters and Scholars of the University of Oxford*. The Statutes made by the Masters for internal self-government were reduced to order by special delegates in the Chancellorship of Archbishop Laud (1636), and this code is the basis of the present Statute-book as regards status and discipline. The seventeenth century was a period of progress, seriously interrupted by the siege of Oxford (1643) and the general confusion of the Civil Wars; the eighteenth one of stagnation in education; but the Royal Society was founded at Oxford c. 1650, and many learned men, such as Butler, Johnson, Gibbon, Warton, Adam Smith, were produced (1700-1800), as well as statesmen and lawyers. The revival of educational activity in the nineteenth century gave rise to an Examination system and more efficient methods of discipline and instruction; while the abolition of religious tests in 1871 (except for degrees in Divinity) throws membership open to all persons who can satisfy the proper authorities of their good character and intellectual competence and pay a small annual fee known as *Dues*. These voluntary subscriptions, together with the entrance fees for examinations, degree fees, and the contributions of Colleges to the *University Chest*, constitute almost the whole revenue of the University itself apart from the endowments in land and stock which it holds in trust for special institutions or branches of learning.

The Constitution of the University as reformed by the first Parliamentary Commission of 1854 and further modified by the second of 1877 is as follows. All Masters of Arts, and Graduates in the *Superior Faculties* of Law, Medicine, and Theology, who have kept their names on the register by payment of £1 per annum, are members of *Convocation* (there were 6,153 in 1893), which from time immemorial has given the sole or final sanction to all financial proposals, decrees, or statutes; it also elects the two burgesses assigned to the University in 1604, and confers the honorary degrees. All members of Convocation who reside within a mile and a half of Carfax, the centre of the city (432 in 1893), constitute *Congregation*, a legislative body which deliberates and amends, but has no initiative. The *Ancient* (i.e. unreformed) *House of Congregation*,

consisting of junior Masters of Arts (*necessary regents* and *regents ad placitum*), heads and deans of Colleges, professors, examiners, etc., retains the power to grant degrees and confirm the appointment of examiners. The initiative for all proposals is vested in the *Hebdomadal Council*, instituted as an administrative board of the *Heads of Houses* in 1631, and in 1854 reconstituted to consist of the Chancellor, Vice-Chancellor, and the two Proctors, with eighteen members elected in equal numbers by *Congregation* from Heads of Houses, Professors, and Graduates generally. The chief official is the *Chancellor*, usually a peer, whose duties are formal. The *Vice-Chancellor*, nominated by him for four years from among the Heads of Houses in rotation, and the two *Proctors* (who, as disciplinary officers, are assisted by four *Pro-Proctors*), elected annually by the Colleges according to a cycle, are charged with the maintenance of discipline, the general superintendence of studies, assemblies, and committees, and the exercise of such patronage as is not left to election. The *High Steward* has cognisance in serious criminal cases, and the *Chancellor's Court*, under the presidency of the Vice-Chancellor or his *Assessor*, exercises a Petty Sessional or County Court jurisdiction. There is a *Public Orator*, a *Keeper of the Archives*, a *Registrar*, and two *Clerks of the Market*. *Bodley's Librarian* (with two *Sub-Librarians*) has charge of the University Library, refounded by Sir Thomas Bodley in 1602. It contains over 30,000 MSS., half a million of printed books, numerous portraits, and other treasures, has the right to a free copy of every work published in the kingdom, and has annexed the *Radcliffe Library* and the whole of the quadrangle of the *Old Schools*. Other University institutions, such as the *Ashmolean Museum* (curiosities and objects of art), the *University and Pitt-Rivers Museums* (laboratories and scientific collections), the *Observatories*, the *Botanic Garden*, the *Indian Institute*, the *Hope Collections* (entomology and engraved portraits), the *Park*, the *Schools* (for examinations), the *Taylor Institution* (foreign literature), the *University Galleries* (sculpture and paintings), are guarded by *Keepers*, under the supervision of *Boards of Delegates*, *Visitors*, or *Curators*, appointed in various ways by the University. The University owns, or holds as trustee, the buildings connected with these, together with meeting-places for secular purposes (*Convocation House*, *Sheldonian Theatre*, *Clarendon Building*, and *Divinity School*), has partial control over the *University Church* of St. Mary the Virgin, and possesses also the *Clarendon Press*, the largest printing establishment in the country for Bibles and learned works. The University and Colleges are represented on the *Council of the City of Oxford*, the *Oxford School Board*, and the *Oxford Incorporation of Poor Law Guardians*. Under a confirmatory Act of George IV. the Proctors and their servants, the *Marshalls*, exercise an exceptional police jurisdiction in the city. The University has its own *Coroners*, *University Counsel*, and *Solicitor*, and servants known as the *Bedells*, *Bellman*, and *Verger*. *Select Preachers* are appointed for those *University Sermons* which are not assigned to University or College authorities or Graduates in seniority.

Ecclesiastical patronage in the actual possession of Roman Catholics lapses under the Acts 3 James I. c. 5, and 1 William and Mary c. 26, to the Universities, Oxford electing to livings in southern, Cambridge to those in northern counties.

The University teaching, originally given partly by private enterprise and partly by the candidates for degrees in the form of the *Disputations* and *Lectures* required at *Determination* and *Inception*, is now furnished by *Professors* and *Readers*, endowed by special benefactors or (since 1854) from the revenues of various Colleges. In the faculty of Theology there are seven Professors; in Law four Professors and two Readers; in Medicine and Natural Science, including Mathematics, fifteen Professors and ten *Lecturers* or *Demonstrators*; in Arts, including languages and history, ancient and modern, and art and music, twenty-two Professors and about the same number of Readers or *Teachers*. The Theology, Law, and Science professors are well organised, and supply much of the formal teaching required for the University curriculum, the informal instruction being given by College tutors and lecturers; but the systematic instruction in languages, literature, and history is almost entirely left to the Colleges, and the professors lecture to empty benches or ladies. (For details see the *University Calendar* and *Historical Register*.)

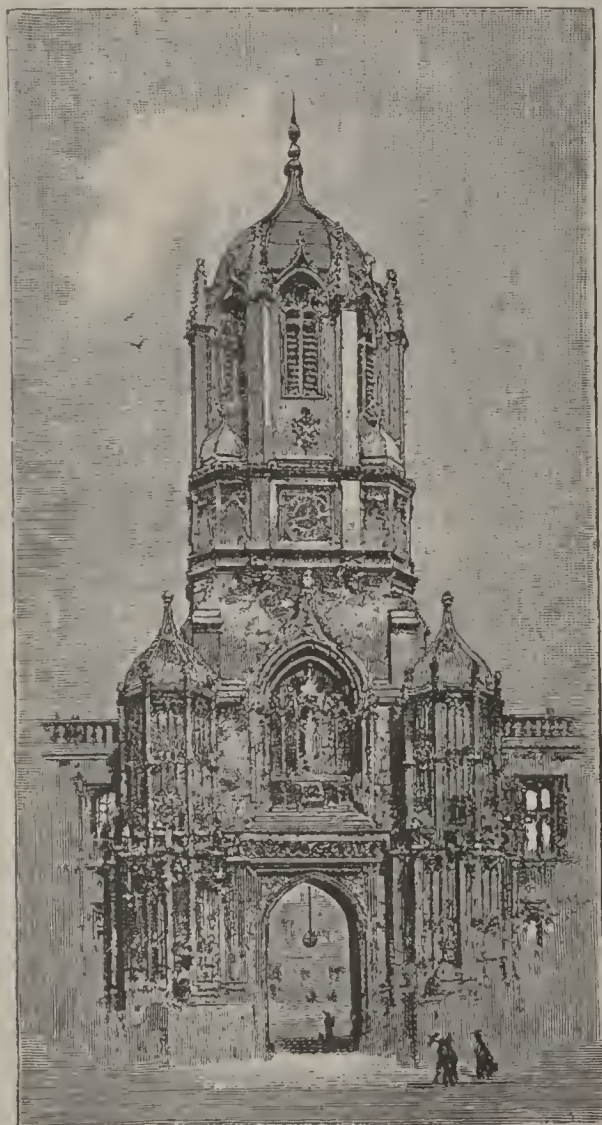
The University now admits its junior members (who are enrolled by a ceremony called *matriculation*) to the degree of Bachelor of Arts only after a series of examinations. In these there are, roughly speaking, three stages: (1) *Responsions* or "*Smalls*" demands an elementary knowledge of Greek, Latin, and Mathematics; it is imposed on all actual or would-be Undergraduates unless they can produce an equivalent certificate recognised by the University, such as that of the Oxford and Cambridge Schools Examination Board; (2) The *First Public Examination* ("*Moderations*" or "*Mods*") differs for candidates for an *Honour* or for a *Pass* career. The latter are examined in Classics and Logic, and proceed to (3) the *Second Public Examination*, either in *Pass Schools* (three examinations in various subjects) or, if they change their minds, can take one of the *Final Honour Schools* ("*Greats*") of Classics (including Ancient History and Philosophy), Mathematics, Natural Science, Law, Modern History, Theology, and Oriental Languages. The Honour man can enter for either *Classical* or *Mathematical* "*Moderations*," or he can take a *Preliminary Examination* in law or science, and then proceed in either case to any of the *Final Honour Schools*; but if he wishes to become a *Passman* after having done a "*preliminary*," his course is more complicated. Honour Schools must be taken with certain limits of standing, *Pass Schools* at any time. In all Honour Examinations the names are arranged in *Classes*. Other rules may be traced in the *Examination Statutes* or found with explanations in the *Student's Handbook to Oxford*, both published by the Clarendon Press. An examination in a small amount of Scripture (or an alternative) has to be passed before a candidate can enter for a final school. Besides these tests of capacity, the University demands

residence (not necessarily continuous) for three academical years, each of which contains two long terms (Michaelmas and Hilary) and two short terms (Easter and Trinity), and consists of 126 days at least. The Christmas and Easter vacations are short; that in the summer is called the *Long Vacation*.

The M.A. degree is granted to those B.A.s whose names have been on the books for seven years from matriculation. There are examinations for the first degrees in law, medicine, and music: for the higher degrees in these, and for both degrees in divinity, theses and exercises, more or less real, are required, together with various conditions as to standing. The system is directed by *Boards of Faculties*, *Boards of Studies* and for the *Supervision of University Examinations*, and *Committees for the Nomination of Examiners*, the members of which are nominated, elected, co-opted, or *ex-officio*. The number of Undergraduates in December, 1893, was 3,232. In 1892 there were 799 matriculations, 583 persons who took the B.A. degree, and 390 who proceeded to that of M.A. There are a large number of *University Prizes* and *Scholarships* and a few *Fellowships* awarded for proficiency in various subjects, mainly after examination or for exercises, to members of the University without limitation except as to standing.

Further regulations with regard to residence and studies are imposed by the *Colleges and Halls*, to one of which, since the time of Laud, all students are required to belong. The *Non-Collegiate* students (1868) are nominally members of the University only, but they are practically under collegiate rules as fully as those who are allowed by their Colleges to reside in lodgings licensed by the University *Controller*. In the earliest times, most students associated voluntarily under a *Principal* in small societies called *Halls*, with common meals and joint funds. In 1274 Walter de Merton founded the first *College* as an adaptation to the needs of University life of the conventual system, and the *Rule of Merton* was soon followed both by the great Benedictine abbeys who built houses for their student-monks, and by bishops and others who wished to provide orderly seminaries for the benefit of particular classes of the community or for the encouragement of special lines of study. Each College was incorporated under statutes sanctioned by the Crown, with endowments held in mortmain for the maintenance of a head and of a definite number of students, soon distinguished according to seniority as *Fellows* and *Scholars*. The Colleges provided for these inmates, not only all the necessities of life, but also tuition and occupation, with a small stipend, which increased with the value of the lands with which they were endowed. They have elective officers for discipline (*Vice-gerents* or *Deans*), finance (*Bursars*), education (*Tutors* and *Lecturers*), and for other purposes. The selection of new members was by co-optation, subject to numerous restrictions as to place of birth, etc.; and the fellowship or scholarship was vacated by marriage, failure to take orders, acquisition of property, and in many other ways. In 1855 and 1882 the statutes of the Colleges were entirely

remodelled by Parliamentary Commissions. Each College is now provided with a *headship*, *official fellowships*, held for terms of years on condition of the performance of certain duties; *non-official fellowships*, for seven years without duties; *scholarships* for undergraduates, awarded with an age-limitation, and *exhibitions* given to the necessitous without regard to age, both after examination. Many scholarships belong to various schools. In most Colleges the majority of the Undergraduates



GATE OF CHRIST CHURCH, OXFORD.

are the *Commoners*, originally elder students allowed to rent spare rooms and pay for a place at the common table, but now young men educated at their own expense. The net corporate revenues are devoted to the endowment of learning within the Colleges or to the support of various University teachers or institutions; and the bulk of the undergraduate's *Battels*, or terminal payments to the College, is for value received in food, lodging, service, or tuition for University examinations. The terms of admission to Colleges vary according to their size and popularity. The following is a list of the existing Colleges, with dates of foundation. In most Colleges the head is elected for life by the fellows and forms with them the *Governing Body*. Each College has a *Visitor* to whom to refer in cases of uncertainty. University College, founded by William of Durham in 1249, and Balliol, by John de Balliol in 1269, as Exhibition Funds were converted into Colleges by their trustees after the foundation of Merton by Walter de Merton in 1264-74;

Exeter was founded by Bishop Stapledon of Exeter, 1316; Oriel, by Adam de Brome, 1326; Queen's, by Robert Eglesfield, 1340; New College, by William of Wykeham, Bishop of Winchester, 1379; Lincoln, by Bishop Fleming of Lincoln, 1427; All Souls', by Archbishop Chichele, 1437; St. Mary Magdalen, by Bishop Waynflete of Winchester, 1458; Brasenose, by Bishop Smith of Lincoln and Sir R. Sutton, 1509; Corpus Christi, by Bishop Fox of Winchester, 1516; Christ Church (including Cathedral establishment of Dean and Canons), by Cardinal Wolsey in 1526 and Henry VIII. in 1532; Trinity, by Sir T. Pope, 1554; St. John's, by Sir T. White, 1555; Jesus, by Queen Elizabeth, 1571; Wadham, by Nicholas and Dorothy Wadham, 1612; Pembroke, by T. Teesdale and R. Wightwick, 1624; Worcester, by Sir T. Cookes, 1714; Hertford (refounded), by T. C. Baring, 1874. Keble, founded in memory of Rev. J. Keble (1870), is on a different footing. The only two Halls which survive are St. Mary Hall (c. 1333) and St. Edmund Hall (c. 1269). There are also three *Private Halls*. The Head is called *Master* at University, Balliol, and Pembroke; *Warden* at Merton, New, All Souls', Wadham, and Keble; *Rector* at Exeter and Lincoln; *Provost* at Oriel, Queen's, and Worcester; *President* at Magdalen, Corpus, Trinity, and St. John's; *Principal* at Brasenose, Jesus, and Hertford; and *Dean* at Christ Church, where the fellows are known as *students*. At Merton the scholars are called *post-masters* and at Magdalen *demies*. Very few Colleges maintain their full number of fellows and scholars, owing to the recent agricultural depression. Only a small proportion of the fellows need now be unmarried or in holy orders.

Colleges were originally provided by their founders with suitable buildings, including Chapel, Hall, Kitchen and Offices, Library, and Chambers (*Rooms*). Most of these have been wholly or partially rebuilt at the expense of the societies, individual members, or new benefactors. The most characteristic in plan and design are those of the great architect Wykeham at New College, which are imitated more or less closely at All Souls', Magdalen, St. John's, Wadham, Oriel, University, Queen's, etc. The best modern works on College history and antiquities are *The Colleges of Oxford*, edited by the Rev. A. Clark (Methuen, 1891), Dr. Ingram's *Memorials of Oxford*, and Messrs. Parker's *Handbook for Oxford*. Information as to the life and studies is given in the semi-official publications mentioned above, and in Mr. J. Wells's *Oxford and Oxford Life*.

Besides its regular functions, the University also supervises by *Delegates* work done mainly by resident Masters, in the Examination and Inspection of Schools, in Local Examinations, in the Instruction of India Civil Service Candidates, in the Training of Teachers, and in the Extension of University Teaching in Local Centres. Female students resident at Halls in Oxford (Somerville, Lady Margaret, and St. Hugh's) and elsewhere are admitted to most lectures and examinations. The University appoints members of the Governing Bodies of many schools and educational institutions. The privileges of *affiliation* have been

granted to St. David's College, Lampeter; University College, Nottingham; Firth College, Sheffield; and similar advantages to the Universities of Sydney, the Cape, Calcutta, the Punjab, Bombay, and Adelaide.

Oxides. The term *oxyde* was first introduced by the great French chemist Lavoisier to indicate compounds which consisted of oxygen united to some other element. With the exception of fluorine, all elements form oxides, which differ greatly in their physical and chemical characteristics. Many elements also form more than one oxide, and the different compounds with the same element are distinguished by prefixes—as *monoxide*, *dioxide*, *suboxide*, etc. Some of these compounds are gaseous, as the oxides of carbon, and sulphur-dioxide; some are liquid—e.g. water—but by far the greatest number are solid bodies. Many of the oxides of the metals occur naturally and form important ores, as the oxides of iron, or of manganese. Some of the oxides are soluble, and may give rise to either acid or alkaline solutions. Thus oxides of chromium and of sulphur form powerful bases; those of potassium and sodium are strongly alkaline. Many of the insoluble oxides dissolve in acids to form salts, the oxides being termed basic oxides; others dissolve in and neutralise alkalies, and so play the part of acid oxides. Some oxides, as alumina, can act either as an acid or as a base, forming aluminium salts and aluminates. All acts of combustion, either rapid or slow, which take place in air or in oxygen consist of the union of the burning substance with the oxygen of the air and the formation of a corresponding oxide. [OXYGEN, COMBUSTION.]

Oxlip (*Primula elatior*), a British spring flower, in some respects intermediate between the primrose and the cowslip, but confined to the north-east corner of Essex and parts of the adjacent counties. On the Continent it is more general. It grows in woods, its leaves resembling those of the cowslip, its inflorescence stalked as in that species, the corolla of a pale yellow, concave but larger than the cowslip, and smelling of apricots, and the calyx hairy. The name is often erroneously applied to primroses that are "caulescent"—i.e. have an elongated peduncle, often resulting from hybridisation between primrose and cowslip.

Oxus, called also *Arnos* and *Jihoon*, is a river of Asia, rising from Lake Sir-i-kol at a height of 15,000 feet in the Pamir table-land, and flowing N.W. and then S.W. through Bokhara and Khiva, and falling into the Sea of Aral, where it forms a delta. Formerly it flowed into the Caspian. Its course of 1,300 miles is mostly through a barren sandy country, and it receives many tributaries in its upper course. Russia and Great Britain made a convention acknowledging the upper Oxus as the boundary of Afghanistan and Bokhara.

Oxy Compounds are a class of compounds which contain oxygen in addition to other elements, as oxy-chlorides, etc. In organic chemistry the term *oxy* is frequently used instead of *hydroxy* to designate compounds in which an atom of hydrogen

has been replaced by the hydroxyl group, HO ; *e.g.* the *oxy* acids of general formula, $C_nH_{2n}(OH) \cdot CO_2H$.

Oxygen. Of all the elements which exist in the accessible portions of our earth oxygen is present in the greatest quantity, forming over one-half the weight of the terrestrial crust. It is also the most widely-diffused element, entering into the composition of almost all the commonly occurring rocks and minerals, usually combined with silicon to form silica or silicates. It forms eight-ninths of the weight of water, and over one-fifth of the volume of the atmosphere, in which latter it exists in the free state. It further enters into the composition of vegetation and of animal life. It is a gaseous element, and was discovered almost simultaneously, and quite independently, by the English chemist Priestley and the Swedish chemist Scheele in 1774. The atomic weight of the element is 16, later experiments giving a slightly lower value, and its density therefore a little greater than that of air. A small quantity may be conveniently prepared by the method in which Priestley discovered it, *i.e.* by heating red oxide of mercury, which at a high temperature decomposes into metallic mercury and oxygen :—



It is, however, better prepared by heating a mixture of potassium chlorate and manganese dioxide, or by strongly heating the latter compound alone in an iron retort. Large quantities are now prepared and sold, charged at high pressures in iron and steel cylinders, and are employed extensively for use in limelight manipulations. A great advance in its preparation was the introduction of Brins' process, depending on the fact that barium-peroxide when heated first absorbs oxygen and afterwards on cooling again evolves the gas. The most noticeable property of oxygen is the manner in which it supports combustion. All substances which burn in air burn with highly-increased brilliancy in this gas. In all cases the act of burning consists in the union of the oxygen with the combustible material, and the formation of oxides. A mixed jet of oxygen and hydrogen burns with the production of an intense heat, and is used for the limelight, water being formed by the union of the two gases. It also plays a most important part in the human and animal economy, and during respiration quantities of oxygen are absorbed into the blood changing its character from venous to arterial. A certain degree of pressure is necessary for this process to take place, and the want of it appears to be one of two factors in the phenomenon known as "mountain sickness." The oxygen so taken into the body is afterwards used to oxidise the tissues of the body, and is evolved chiefly in the form of carbonic acid and of water from the lungs, skin, and kidneys. The energy of living animals is derived from the heat liberated during such slow oxidation. Plants, however, in their chlorophyll portions possess the power under the influence of sunlight of liberating the oxygen from carbonic acid, with a consequent assimilation of the carbon. It is slightly soluble in

water, a most important quality, as the life of fish, like animals, is dependent upon an adequate supply of oxygen, and they derive this supply from the gas which is contained dissolved in the water. By the recent beautiful experiments of Professor Dewar oxygen and air have been liquefied and even solidified at a very low temperature. Oxygen in this state is a blue liquid, which is attracted by a magnet, and in which alcohol and carbonic acid, etc., immediately solidify.

Oxyhydrogen Light. [LIMELIGHT.]

Oyster, the name of the molluscs belonging to the genus *Ostrea*, and the type of the family Ostreidæ, which belongs to the sub-class Monomya, as it has only one adductor muscle for the closing of the shell. The animal is enclosed in a bivalved shell, of which one valve is flat or concave and free, and the other thickened and convex. The latter is that by which the animal is attached, and was considered to be the left valve ; later study of the development, however, has shown that it is the right valve. The oyster is a convenient type of the Monomya for dissection, but it is somewhat abnormal, as the heart is really four- instead of three-chambered, and the common species (*Ostrea edulis*) is alternately male and female. The nephridia or kidneys, moreover, consist of long blind tubes, instead of being compact, as in most Lamellibranchs. Oysters are all marine, and usually live in shallow water ; they are, however, often met with in brackish water, but are then small and ill-developed. They are usually gregarious, but are delicate, and are readily killed by frost, fresh or impure water. They have numerous enemies, the spat being eaten by small fish, and adults by starfish, while a boring sponge (*Clusia*) often riddles and ruins the shell. The oysters spawn in May and June. The spat is often collected and allowed to develop in shallow tanks, and these oysters are then known as "natives" ; such rearing-grounds are usually in estuaries as at Whitstable and Burnham on the Crouch. The oyster is not mature for from four to five years, and may live for several years longer. The season lasts from September to April, whence the old saying "that oysters ought never to be eaten unless there is an 'r' in the month." *Ostrea edulis* is the common English species, but other species are eaten elsewhere. The genus contains many species, and ranges from the Carboniferous upward.

Oyster-Catcher, any bird of the genus *Hæmatopus*, of the family Charadriidæ (Plovers), with nine species, universally distributed. The Common Oyster-catcher of Europe (*H. ostralegus*) ranges as far north as Greenland and south to central Africa. The adult male is about sixteen inches long ; its black-and-white plumage (whence it is called Sea-Pie) contrasts well with the orange feet and red bill. In Britain the favourite habitat is the east coast. The name Oyster-catcher conveys a wrong impression, for the chief food of these birds consists of mussels, crustaceans, worms, and small fish. They usually breed on the shore, but their nests have been taken some distance inland.

Ozæna, the term applied to the intensely disagreeable smell which is associated with some forms of disease of the nose. Ozæna occurs in ulceration of the nasal mucous membrane, catarrh of the nasal bones, and in a peculiar form of chronic inflammation which sometimes affects the lining membrane of the nose.

Ozokerite, or MINERAL WAX, occurs largely in Roumania and Gallicia, and consists of a mixture of a number of hydrocarbons of the paraffin series. [PARAFFIN.] If purified, it is used as a substitute for beeswax, and is known by the name of *Ceresine*.

Ozone is a modification, or *allotropic* form of oxygen, which was discovered in 1840. It is composed solely of oxygen, although its properties are markedly different. The difference is explained by the assumption, that in ozone three atoms of oxygen are united to form a single molecule, whereas in oxygen itself the molecule consists of but two atoms. That three volumes of oxygen form two volumes of ozone was shown by the experiments of Andrews and of Sorel. It is formed during a silent electric discharge through oxygen, and is produced in small quantities during electrolysis, and most slow oxidations, *e.g.* of phosphorus. It possesses a powerful penetrating odour, and acts as a more powerful oxidiser than oxygen, acting on many substances unaffected by the latter element. At low temperatures it may be condensed to a blue liquid. It is present to a slight extent in the atmosphere near the sea and in the open country, but in the neighbourhood of towns it is absent, being used up in destroying the organic material also present in the air.

Ozymandias, a king of Egypt mentioned by Diodorus Siculus. He is said to have invaded Asia, to have penetrated to Bactria, and to have erected, on his return to Thebes, a colossal statue and a monument as memorials of his expedition.

P

P, *p*, the fifteenth letter of the Latin, and the sixteenth of the English, alphabet, the hard labial voiceless stop or explosive consonant formerly called the hard labial mute. The character is derived from the Phœnician *p̄*, through the Greek *π*, Π. Though common in English, it is seldom found in words of Anglo-Saxon origin. Before *m*, as in *topmast*, the *p* sound is produced, not by opening the lips, but by lowering the *velum pendulum*, and so letting breath pass through the nose. In some words of Greek origin *p* is mute before *n* and *s*, as in *pneumatic*, *psalm*.

Paca, any individual of the American rodent genus *Cœlogenys*, with a single species (*C. paca*), ranging from Guatemala to Paraguay. With the *Agoutis* the *Pacas* constitute the family *Dasyproctidæ*. These animals are about 2 feet long, stoutly-built, yellowish-brown above and whitish below, with from three to five longitudinal bands of white

spots on each side. They run fast and swim well, are partially nocturnal in habit, and generally burrow near water. Their diet is exclusively vegetable, and they do considerable damage in gardens and sugar-plantations. The flesh is esteemed a delicacy.

Pachydermata, Cuvier's name (now lapsed) for the thick-skinned, non-ruminating Ungulates (*q.v.*).

Pacific Ocean, THE, is the name given by Magellan, in 1520, to the vast expanse of water which divides America from Asia. It measures 9,000 miles from south to north, whilst its breadth varies from 40 miles at Behring Strait to 10,000 miles between Quito and the Moluccas. The area may be reckoned as about 68,000,000 square miles. Its depth is greater than that of any other ocean, averaging 2,500 fathoms. The surface is affected by the equatorial current sweeping across the entire breadth from east to west and branching off southwards to the Polynesian Archipelago and Australia and northwards to Japan and Kamschatka, and by the southern Pacific counter-current flowing from Tasmania eastward and dividing into the Cape Horn and Peruvian currents. The highest temperature of water is found somewhat north of the equator, and the temperature of the southern is lower and more equable than that of the northern portion. As regards prevailing winds, the Pacific differs from the Atlantic in having a narrower equatorial belt of calms, and this affects the course of the trade-winds. Southerly and south-easterly monsoons blow during the summer months, and are reversed in winter, though liable to deflections in the neighbourhood of continents.

Packard, ALPHEUS SPRING, was born in Maine, U.S.A., in 1839. Having graduated at Bowdoin College, he became assistant to the great naturalist Agassiz, and was employed in various scientific expeditions. From 1874 to 1879 he held the post of state naturalist in Massachusetts, and was next elected to the chair of natural history in Brown University. Besides popular works and contributions to scientific periodicals, he has published treatises on *The Structure of the Ovipositors of Insects*, *The Development and Structure of Linulus Polyphemus*, *The Cave Fauna of North America* and *The Labrador Coast*.

Pactolus, THE, a river of Lydia, Asia Minor, identified with the modern Sarabat in Anatolia. It rises in Mount Tmolus, and joins the Hermus about 50 miles east of Smyrna. Among the ancients its name was synonymous with wealth, owing to the gold which its sands contained.

Paderborn, a town of Westphalia, North Germany, 41 miles south of Minden, at the source of the river Pader. Founded by Charlemagne, it was for centuries a free imperial city, and a powerful member of the Hanseatic League. In 1803 it was acquired by Prussia, but Napoleon included it in Westphalia, to which it belonged until the repartition of Germany in 1813. The streets are ancient and narrow, and the fine cathedral, dating from the 12th century, contains the relics of St. Liborius.



1. Smut (*Ustilago carbo*). a, on oats; b, on wheat; c, on barley; d, spores; e, spores germinating.
 2. Bunt (*Tilletia caries*) on the grain of wheat; c, the attacked grain in section.
 3. Smut (*Urocystis occulta*) on rye; b, the multicellular spores.
 4. Ergot (*Claviceps purpurea*) on rye. a, ear of rye with sclerotia of ergot; b, sphaecelia stage; c, young ovary attacked; d, sclerotium bearing seven stromata; e, stroma in section; f, perithecium in section; g, ascus with ascospores.

5. Corn Mildew (*Puccinia graminis*). a, Teleutospores (Puccinia stage) on leaf-sheath of corn; b, Uredo-stage on leaf of corn; c, Barberry, with Aecidium-stage; d, Uredospore germinating; e, Uredospores and teleutospores on the same mycelium; f, Teleutospore germinating; g, aecidia and antheridia in barberry leaf, in section.
 6. Vine Mildew (*Oidium Tuckeri*); b, the same magnified, showing acrospores.

7. Potato Disease (*Phytophthora infestans*). a, potato leaf attacked; b, sporangiophore emerging from stoma; c, zoospores; d, spore penetrating epidermis; e, hypha entering stoma.
 8. *Rhytisma acerinum* on leaf of maple.
 9. *Hysterium nervisequium* on leaves of fir.
 10. *Exoascus pruni* a, plum attacked; b, asci with ascospores.

The town is still the seat of a bishopric and of an important Catholic seminary.

Padilla, JUAN LOPEZ DE, born at Toledo about 1490, rose in the service of Charles V. to be military governor of Saragossa. He joined in the movement against the oppressive misgovernment of the king, and became head of the Junta which set up the imbecile Joanna as sovereign. In the *Guerra de las comunidades* which followed, Padilla gained some success, capturing Torrelobaton and other places. However, in 1522 he was overwhelmed and captured at Villalar. On the day after his defeat he was beheaded; but his wife defended Toledo after his death, and is associated with him in many Spanish ballads and legends.

Padua (Lat. *Patavium*; Italian *Padova*), a city of North Italy, situated on the river Bacchiglione, 25 miles west of Venice. In the early days of the Roman republic it was a considerable place; but at the fall of the empire it suffered severely from the Huns, and passed twice from the Gothic kings to the Greek emperors. It went through the various vicissitudes of the towns of North Italy until acquired by Venice in 1403, after which date its history becomes identical with that of Venetia. The university of Padua, founded by Frederick II. in 1238, was throughout the Middle Ages one of the most famous schools of Europe, and it still retains great vitality. Among the many striking architectural features may be mentioned the Palazzo della Ragione (1172), with a roof of larger span than any in Europe; the Piazza dei Signori; the Palazzo del Capitano; Il Santo, or the basilica of St. Antony; the Augustinian church of the Eremitani, with frescoes by Mantegna; the Capella dell' Arena, decorated by Giotto; and the cathedral, where Petrarch's tomb is seen. The city possesses some industries, such as weaving and dyeing silken and woollen fabrics, and it does a considerable trade in grain, cattle, wine, and oil.

Pædogenesis is reproduction by immature animals; it occurs in the larvæ of some flies (*e.g.* *Heteropeza* and *Chironomus*). It occurs among vertebrates in the amphibian Axolotl of Mexico and in *Triton alpestris* of Switzerland, and also in some fish.

Pæstum (Greek *Posidonia*), a Greek colony on the coast of Lucania, founded about 600 B.C. by settlers from Sybaris. It speedily rose to great prosperity, and preserved its independence for several centuries, being conquered at last by the Lucanians, and passing ultimately into the possession of Rome, when it took the name of Pæstum. The temple of Poseidon is one of the finest monuments of Doric architecture.

Paganini, NICOLÒ, was born at Genoa in 1781, and at the age of nine made his first public appearance with complete success, but he passed the next twelve years in study and composition. He then began a series of tours through Europe, exciting astonishment everywhere by his marvellous performances. It was not, however, until 1831 that he played in Paris and London. The zenith of his fame was reached in 1834, when Berlioz composed

for him the well-known symphony *Harold en Italie*. His health soon after declined, and he died in 1840, at Nice, of laryngeal consumption.

Paget, SIR GEORGE EDWARD, K.C.B., M.D., was born in 1809, and went from Charterhouse to Caius College, Cambridge, where he graduated as eighth wrangler in 1831, subsequently being elected to a fellowship. Almost the whole of his career was spent at Cambridge as a teacher and practitioner. In 1872 he became Regius Professor of Physic, and from 1869 to 1874 he was President of the General Medical Council. He died in 1892.

Paget, SIR JAMES, BART., F.R.S., LL.D., his brother, was born in 1814, and, after a course of study at St. Bartholomew's Hospital and elsewhere, became member of the College of Surgeons in 1836 and fellow in 1843, acting as professor of surgery and anatomy from 1847 to 1852, and being elected to the Presidency in 1875. He has for many years been on the Senate of the University of London, and was Vice-Chancellor from 1884 to 1886. He has received honorary degrees from various universities, and is a member of the French Institute.

Pagoda, in the East, where the Buddhist religion is professed, a sacred tower built in several storeys, of which the number is always odd. Such towers were originally raised over a relic of Buddha or of a Buddhist saint. They are generally more or less pyramidal, as is the famous Great Pagoda of Tanjore. The name is also applied to gold coins with a pagoda figured on the reverse, current in India from the 16th century, worth about 7s. 1d.

Pagurus, the best-known genus of the Hermit-Crabs (q.v.).

Paine, THOMAS, was born in 1736, and, after various efforts to make a living, emigrated to America at the age of thirty-eight. Soon after his arrival he published a pamphlet, entitled *Common Sense*, which is admitted to have turned the majority of the colonists against the mother country. He now joined Washington's army as a private, and was appointed secretary to the Foreign Committee of the first Congress. Returning to England, he brought out in 1791 *The Rights of Man* as a reply to Burke's *Reflections*. This brought a prosecution for treason upon Paine, but the Government allowed him to escape to France, where he had been elected to the Convention as the representative of Calais. His moderation incurred Robespierre's enmity, and he narrowly escaped execution. Whilst under confinement he composed the first part of *The Age of Reason*, which had the effect of depriving him of much sympathy. In 1792 he went back to America, but wrote nothing of importance in the interval before his death, which took place in 1809.

Painted Lady, a widely-distributed English butterfly, which is one of the few which live for two summers. It hibernates during the winter. Its scientific name is *Pyrameis cardui*.

Painter's Colic (*Colica pictorum*). The continued absorption into the system of minute doses of certain lead salts gives rise to a form of chronic

poisoning known as *plumbism*. One of the most characteristic symptoms is the occurrence of severe attacks of abdominal pain associated with obstinate constipation, and in some cases certain nervous symptoms are also present, the best known of which is the characteristic *wrist-drop* due to paralysis of the muscles which extend the wrist upon the fore-arm. In rare instances optic atrophy and convulsive seizures occur in connection with lead-poisoning, and plumbism appears to have some connection with gout. A remarkable symptom which is usually present in the subjects of lead-poisoning, and which materially facilitates the diagnosis of the condition, is the "lead-line," a blue line which is developed at the margin of the gums at the point of junction with the teeth. Lead-poisoning may originate in many ways. It is sometimes due to the action of drinking-water upon the leaden pipes through which it is conveyed for domestic use. It was at one time common in Devonshire, and was attributed to the use of leaden vessels in the manufacture of cider in that county. The usual cause of the disease nowadays is the manipulation of salts of lead which is carried on by those who work in places where white-lead is manufactured, and by those engaged in the glazing of pottery and by painters, plumbers, etc. Treatment consists in the removal of the cause where possible, and in the case of those who must continue their employment the most careful attention to cleanliness is imperative. It is said that the use of sulphuric-acid lemonade to a great extent protects lead-workers from the malady, and improvement in processes of manufacture has of late years considerably diminished the number of cases of the disease. In the elimination of lead from the system iodide of potassium is of considerable value. Lead colic is dealt with as a rule by use of opium and avoidance of strong purgatives. In treatment of wrist-drop electricity is commonly employed.

Painting. The art of painting has been practised from very remote times. At first, however, it was employed simply to adorn sculpture. The earliest known paintings are those of the Egyptians, who used a sort of distemper (q.v.); the Assyrians also extensively decorated their walls with paintings, but little is known as to the development of the art in Greece, although there is little doubt that it by no means equalled their sculpture. Rome made no great advance, and it was reserved for the Italians of the middle ages to make the immense advance upon the old Byzantine school. [CIMABUE, GIOTTO.] Van Eyck (q.v.) discovered "oils," and from that time the practice of oil-painting gradually spread. Further details will be found under the names of the various great artists. [BOTTICELLI, DÜRER, RAPHAEL, MICHELANGELO, RUBENS, REMBRANDT, TITIAN, VELASQUEZ, etc. etc.]

Paisley, a municipal and parliamentary borough of Renfrewshire, Scotland, situated seven miles S.W. of Glasgow, on the White Cart river near its junction with the Clyde. The town grew up round an abbey which probably occupied the site of a Roman fort (Vanduarra), and in 1488 it received a charter. Thread and cotton are now the staple products, but

soap, starch, cornflour, and other articles are largely manufactured. There are also bleaching, dyeing, and printing works, engineering sheds, and ship-building yards, the river having been rendered navigable to vessels of 50 tons. Except the abbey, one of the finest relics of ecclesiastical architecture in Scotland, all the public buildings are modern. There are three public parks and several monuments.

Pakhpa, a people of East Turkestan, who give their name to the Pakhpuluk district, on the northern slopes of the Muztagh Mountains, South Yarkand. Although described as "Tatarised Aryans," the type—tall, fair complexion, light eyes, sandy hair and whiskers, regular Caucasian features—shows that they are of pure Aryan descent, perhaps originally from Cashmere or Chitral; but they now speak a corrupt form of the Yarkand-Türki language, and have long been Mohammedans (Forsyth, *Mission to Kashgar*, pp. 61 *et seq.*).

Palæechinoidea, a sub-class of Echinoidea, or Sea-Urchins, including all the Palæozoic and some Triassic species. The only character by which it differs from the other sub-class, or Euechinoidea, is that the plates are not arranged in twenty zones. It includes four orders—the Bothriocidaroidea, Perischoechinoidea, Plesiocidaroidea, and Cystocidaroidea. *Palæechinus* is the best-known genus.

Palæichthyes, a sub-class of fishes, containing the Ganoid Fishes (q.v.) and the Elasmobranch Fishes. [CARTILAGINOUS FISHES.]

Palæoblattina is the oldest known insect; it belongs to the order Palæodictyoptera (q.v.), and is found in the Silurian rocks of Calvados, in Normandy.

Palæocoryne, a genus of fossils from the Carboniferous rocks of Scotland, which was of interest as it was referred to the Hydrozoa and the order Corynida. It is, however, now known to be really part of a Bryozoan (q.v.).

Palæodictyoptera is an extinct order of insects including all the Palæozoic and a few Triassic species. The order was founded by Scudder, and, as formally diagnosed, it includes a group of insects with an incomplete metamorphosis, two pairs of wings which are equal in size, membranous in texture, and simple in the arrangement of the thickened lines usually known as "nerves"; their characters are therefore of a simple primitive type. The value of the order is, however, very doubtful, and it appears most probable that it will have to be split up among the four orders of Orthoptera (cockroaches, etc.), Neuroptera (may-flies, etc.), Hemiptera and Coleoptera (or beetles). Thus the oldest known insect *Palæoblattina*, and the Carboniferous cockroach *Progonoblattina*, and the old "stick-insect" *Protoplasmoda* appear to be primitive forms of the Orthoptera. *Platephemera* is probably an old member of the *Ephemeridae* or May-flies. *Lithomantis* and *Miamia* are also both allied to the Neuroptera. The Hemiptera or Rhynchota is represented by the Permian *Eugereon* and *Fulgorina*, and the Coleoptera by some beetle's wing cases or elytra and some borings in the Carboniferous.

Palæography, the art of deciphering ancient writings ; it includes a knowledge of the abbreviations and of the various modes of writing in use at various periods. Diplomatics is the science of ascertaining the authenticity or date of ancient documents.

Palæolithic, the older Stone Age, the oldest prehistoric division of the human period, when, towards the close of the Glacial Period, man was associated with an assemblage of mammals, many of which are extinct, and used rude stone implements, chipped but not polished. The remains of this age are obtained from high-level river-gravels and brick-earths, and the lower deposits in some caves. The fauna of these deposits contains an admixture of northern and southern types, including lion, hyæna, and hippopotamus, with reindeer, glutton, lemming, and musk-ox, together with the extinct mammoth (q.v.), the woolly rhinoceros, and the cave-bear, and, perhaps, *Elephas antiquus*. Bones of man himself belonging to this age have but rarely been found ; but in some of the caverns in which they do occur, as in that of La Madelaine, in Périgord, they are associated with rudely-executed but graphic incised pictures of the mammoth, reindeer, and other animals, cut by primitive man on bone and ivory. Palæolithic man in N. Europe seems to have been mainly engaged in hunting and fishing. [FLINT IMPLEMENTS.]

Palæologus, the name of a Byzantine family which came into prominence about the middle of the 11th century, when GEORGE PALÆOLOGUS helped to confer the purple on Alexius Comnenus II. and to defend Durazzo against the Normans. MICHAEL, in 1260, raised himself to the imperial throne, and founded a dynasty which only ended with Constantine XIII. (1448-53), the last emperor of Byzantium. The brothers of this latter held sway for some years longer in the Morea and Achaia, whilst Zoe, his sister, married Ivan III. of Russia.

Palæontology (named from the Greek *palaios*, "ancient"; *onta*, "beings"; *logos*, "science") is the science of fossils (q.v.). In its method it is largely a distinct science; but in its results it may be considered as the contribution of geology (q.v.) to biology (q.v.). Owing to the merely partial preservation of their remains, fossil plants and animals are studied from somewhat different points of view from those of which flowers or muscles are still available ; and, whilst all existing plants and animals are contemporaneous, one of the chief interests in the study of fossils arises from their presenting to us a succession, the floras and faunas of successive past periods of the earth's history. Fossil organisms not only add large numbers of species and genera to those now known as living on the globe ; but many of them belong to extinct types, some of which are *generalised*, or combine the characters of groups which have since become distinct, and may, therefore, well be looked upon as *ancestral*. Though there is abundant evidence of a general succession, or advance of organic types, the lower in organisation being, on the whole, the earlier in appearance in time, there is still a great *imperfection of the palæontological record*. Thus we have no geological

evidence as to the beginnings of life on the globe, the earliest known assemblage of fossils, that in the Lower Cambrian (q.v.), containing representatives of nearly all classes of invertebrate animals. Again, though in many groups, as, for instance, among ungulate mammals, there are now known a large graduating series of genera ; in this and in many other groups it is impossible to point to the minute inter-gradation of species which would seem to be required by the theory of natural selection. In other groups, however, such as the brachiopods, the ammonites, and the whelks, such an inter-gradation can be fairly well shown. This imperfection of the record arises in part from the as yet incomplete investigation of our fossiliferous rocks ; but also from the destruction by denudation of such rocks once in existence ; from the obliteration of the fossils in others, as by percolating water or crystallisation due to heat ; or, still more, from the scant chance of preservation as fossils of the remains of plants and animals dying at a distance from water and its preserving mud. These latter causes render many of the gaps in our knowledge irremediable. Nevertheless, Sir A. Geikie expresses the opinion that "it must be conceded that, on the whole, the testimony of the rocks is in favour of the doctrine of evolution."

Palæotherium, a genus of extinct ungulate mammals, the type of a family, *Palæotheriidae*, which combines the characters of the rhinoceros, tapir, and horse. The species range in size from that of a pig to that of a horse, four or five feet high. They had a short, fleshy snout, like the tapir (q.v.), but had only three toes on each foot. The range in time of the genus is from the Middle Eocene to the Upper Oligocene, the earliest types being described by Cuvier from the gypsum beds of Montmartre.

Palæozoic Rocks, the oldest group of fossiliferous rocks, formerly termed *primary*. They consist largely of sandstones and shales, with greywacke and slate in the lower part of the group, and limestone, coal, and dolomite in the upper, and numerous great thicknesses of contemporaneous volcanic rocks. The group is subdivided into six systems, as follows :—

- UPPER PALÆOZOIC.—Permian System.
- Carboniferous System.
- Devonian System.
- LOWER PALÆOZOIC.—Silurian System.
- Ordovician System.
- Cambrian System.

On account of their great relative age, Palæozoic rocks have been more subject to disturbance than others, and are often bent, contorted, faulted, cleaved, and otherwise metamorphosed, whilst the Secondary or Mesozoic rocks (q.v.) commonly rest unconformably upon them in more horizontal positions.

The fossils of the Palæozoic rocks are widely different from living organisms. In the lower systems there is little evidence of plants or land-animals. The plants of the upper systems include large club-mosses and horse-tails, ferns and conifers ; but no known angiosperms. The corals belong

mainly to the *Tetra-coralla*; sea-urchins are rare, and have more than twenty rows of plates; and the extinct classes of echinoderms, the *Blastoidea* (q.v.) and *Cystoidea* (q.v.), occur, as well as numerous crinoids. Graptolites (q.v.), trilobites (q.v.), and *Eurypterida* (q.v.) are confined to Palæozoic rocks, and *Orthoceratidæ*, straight allies of the pearly nautilus, are nearly so. *Brachiopoda* (q.v.) were more abundant than in subsequent times; *Pelecypoda* and *Gastropoda* less so. The insects all belonged to an extinct generalised sub-class, the *Palæodictyoptera* (q.v.); and the fish had cartilaginous skeletons and unequally-lobed tails. No mammals or birds are known from Palæozoic rocks. Only sixteen genera of organisms, and no species, are now alive that were living when they were deposited.

Palanquin, a covered litter (used in India and other Eastern countries) with poles fitted to it before and behind, so that it is borne on the



JAPANESE PALANQUIN.

shoulders of two, four, or six bearers. It is generally constructed to hold one, being a box about eight feet long and half as wide and high, with shutters like light Florentine shutters. The Japanese palanquin or *norimond* has one pole fixed along the top.

Palate. This is the name given to the roof of the mouth. Anteriorly, extending between the alveolar processes of the upper jaw, the palate has a bony framework, upon which the mucous membrane of the upper part of the mouth is moulded. This is the *hard palate*. Behind it lies the *soft palate*, which has no bony support, but arches over, forming on each side what are known as the *pillars of the fauces*, and in the middle line a projection which is called the *uvula*. The pillars of the fauces are two in number on either side— anterior and posterior—and between the anterior and posterior pillar of each side lies the tonsil. Cleft palate is met with in young children as the result of non-union of parts by mal-development. It is often associated with hare-lip, and requires to be treated by surgical operation.

Palatinate, THE (German *Pfalz*, “palace”), the name used to designate the fief of the Palsgraves or Counts Palatine of the Rhine, who from the 11th century had their seat at Aix-la-Chapelle and ruled

over a wide and productive area of 2,293 square miles, extending from Mayence to Trèves. This constituted the Lower Palatinate, or Palatinate of the Rhine. In the 13th century the province passed into the Bavarian family by the marriage of Otho II. with Agnes, heir to the Suabian Palsgraves, and thus there came into existence an Upper Palatinate in Bavarian territory, with an area of 3,750 square miles, lying between Bavaria proper, Bohemia, and Nuremberg. In 1680 the two districts became separated, and until 1777 remained asunder, being then reunited under Charles Theodore. By the Treaties of Paris (1814–15) a fresh partition took place. Most of the Electoral or Lower Palatinate was given to Prussia, of which it still forms part, and a smaller share to Hesse-Darmstadt, whilst the Upper Palatinate passed into Rhenish Bavaria, with the exception of a small strip added to Baden.

Palatine, holding or pertaining to a high office in an imperial palace (Lat. *palatium*), originally the office of treasurer to the Roman and Byzantine emperors. In mediæval France and Germany the term was applied to the jurisdiction of high officials under the Empire who enjoyed royal privileges, and later especially to the electoral principality known as the Palatinate. In England the ruler of a county palatine (*i.e.* of Lancaster, Chester, and Durham) enjoyed royal privileges, such as special courts, judges, constables, and stewards, and even a parliament of their own.

Palembang, a town in the Dutch colony of Sumatra, capital of a province of the same name. It stretches for three miles along the banks of the Musi river, at a distance of 50 miles from its mouth. Many of its houses are built on piles driven into the river bed. A large trade is carried on with neighbouring ports, and coal is found of fair quality.

Palenque, a village in the province of Chiapas, Mexico, 100 miles E.N.E. of Ciudad Real. Near it exist some of the finest ruins of Central America, comprising temples adorned with figures in relief and hieroglyphs, pyramidal structures, colossal statues, and other remains, probably of palaces and dwellings, covering a large area, and overgrown by dense jungle. They were discovered in 1750.

Palermo (classical *Panormus*), a city on the N.W. coast of Sicily, probably founded by Phœnicians. It became the centre of Carthaginian power, retaining for many centuries its Semitic associations. In 254 B.C. it fell into Roman hands, where it remained until Genseric captured it in 440 A.D. Belisarius recovered it a century later, but in 835 the Saracens made it their capital. The Norman Guiscards next became its masters, and Palermo enjoyed independence, if not supremacy, from 1071 to 1282. It has since shared the fate of Sicily, and was finally reduced from its position as capital of a kingdom to that of a provincial chief town in 1860. Conspicuous among these monuments are the Metropolitan church, the chapel of the king's palace, the Martorana, and the mosque-like edifice dedicated to San Giovanni degli Eremiti. The harbour accommodation is not very good, being

provided by a mole stretching a quarter of a mile into the sea. There is an arsenal, and some ship-building is carried on. The city is the seat of an archbishopric and university, and is the centre of administration for the island. The manufactures are limited to a few silk and cotton goods, gloves, straw hats, and chemicals. Fruit and agricultural produce are exported.

Palestine (*Palæstina*), or the HOLY LAND, the southern part of Syria, comprising the region apportioned by Joshua among the twelve tribes of Israel, but never occupied by them throughout its whole extent. It lies between lat. 31° and $33^{\circ} 20'$ N., and is bounded on the W. by the Mediterranean; towards the E. it is impossible to assign any precise limit. The area of the cis-Jordanic portion is 6,000 square miles, and that of the remainder cannot at any time have exceeded 3,800 square miles. Just as the old name Canaan denoted originally the low-lying country along the coast, so Palestine means literally "Land of the Philistines," and was not used of the inland districts before the time of the Romans.

Physical Characteristics. Notwithstanding its narrow limits, Palestine presents a remarkable variety of surface, scenery, and climate. The central portion consists of an undulating tableland (the "hills" or "hill-country"), separated from Lebanon on the N. by the fertile Plain of Esdraelon (Jezreel), which is 20 miles long and 9 miles broad. It has a gentle slope towards the W., but descends abruptly to the Jordan valley, the surface gradually rising, as it extends southwards, till it reaches its greatest elevation (about 3,300 feet) in the neighbourhood of Hebron, beyond which, near Beersheba, it sinks into the Idumæan Desert. The northern part of this tract is more fertile than that towards the S., the least productive district being the country round Jerusalem; but even there, the vine is grown with success, and the barren aspect of the plateau is relieved in many places by gardens of olives and figs and luxuriant cornfields. There is no reason to suppose that the quantity of timber in this region—as represented by the oak, terebinth, fir, sycamore, cedar, acacia, etc.—has decreased since the Old Testament period. To the W. of the central tableland and the Lebanon ranges, N. and S. of Mount Carmel, there runs a strip of low seaboard, which expands into the plain of Philistia as the coast trends away to the S.W., N. of Philistia (an agricultural district with a rich soil) is the Valley of Sharon, once the Garden of Palestine, but now for the most part a marshy or sandy wilderness, owing to the destruction of the irrigatory system and the formation of dunes to a distance of several miles inland. To this section belongs also the Shephelah ("low ground"), a low ridge between the high watershed range and the plain, renowned both in ancient and modern times for the excellence of its crops. The maritime plain is intersected by deep gullies, traversed in some cases by perennial streams. Oranges, lemons, citrons, bananas, and melons grow luxuriantly, especially in the gardens of Jaffa and Ascalon. E. of the central tableland is a deep fissure (El-Ghôr), increasing in width from 5 to 13 miles, down which the Jordan flows

with tortuous course (100 miles as the crow flies, but in reality nearly twice that length), from the base of Mount Hermon (1,000 feet above the Mediterranean), through the Waters of Merom (Bahr-el-Huleh), to the Dead Sea, which is 1,292 feet below its level. Beyond Jordan is another upland district, forming a prolongation of the Anti-Libanus ranges, with an elevation of 2,000 to 3,000 feet, succeeded on the E. by a plateau which stretches away to the Arabian Desert. This region contains wide tracts of excellent pasture. The highest point in Palestine is Jebel Jermuk (3,934 feet). The height of Ebal is 3,084 feet; that of Gerizim 2,849 feet; and that of Carmel—a north-western spur of the uplands terminating in a



MAP OF PALESTINE.

promontory—1,740 feet. The Jordan is the only important river; but the Kishon—a turbid stream, swollen after the rains, but dry for part of its course in summer—is interesting from its Biblical associations. Springs are abundant in the hill-country of Galilee, Samaria, and Judæa; but in Philistia the water-supply is derived entirely from cisterns. The climate varies greatly in different districts. The rainy season begins with the autumnal equinox. Thunderstorms are common in November and December; but the heaviest fall takes place in January, after which the weather begins to clear, though rain does not cease till the vernal equinox is over. With the exception of a single heavy shower in June or July, there is seldom any rain between end of April and beginning of October.

History. The giant races to which allusion is made in the Old Testament—races of Aramæan descent, and therefore akin to the Israelites—were conquered by tribes known collectively as Canaanites, whom the Israelites found in possession when they arrived from Goshen (about 1274 B.C.). According to the Biblical account, they were Hamitic, but linguistic evidence points rather to a Semitic origin. The Philistines in the S.W. belonged to a different stock; their ancestors must probably be sought amongst the Egyptian Caphtorim. These races were not extirpated, nor did they lose the whole of their territory, for the limits assigned to

the Israelitish tribes must be regarded as prospective rather than actual. The central tableland or hill-country W. of the Jordan was the only part of Palestine of which they ever secured a firm hold. The Philistines especially maintained their supremacy over a considerable area, and long after the migration they frequently inflicted crushing defeats on the Israelites. There is even some ground for believing that the modern Fellahin are descended from the people who occupied the land before the Jewish invasion. E. of the Jordan Israel carried on a ceaseless struggle with various Semitic tribes. The children of Reuben were frequently driven from their walled towns by Moabites from beyond the Arnon, and farther N. there were the Amorites in Gilead and Bashan, and the Ammonites on the confines of the Arabian Desert. Moreover, for several centuries after the Jewish settlement, these tribes, with others of the same stock—Amalekites and Midianites from the S. and S.E.—often invaded Palestine proper and held it for long periods as a tributary province. In all cases they were eventually driven out by leaders called Judges (*Shofetim*), who exercised temporary authority over one or more tribes. After the choice of a single and permanent king (1067 B.C.), the sense of national unity grew stronger, and tribal distinctions tended to disappear, although Ephraim fostered a jealousy of Judah which ultimately led to the most disastrous results. Under Saul's successors Israel advanced to a high position among the nations of the East. The stately city which grew up on the site of the rock-fortress wrested by David from the Jebusites became the capital of a dominion extending from the Euphrates to the borders of Egypt, and the treaty of Solomon with Hiram, King of Tyre, brought the Jews into commercial relations with the most remote regions of the known world. This period of prosperity (1055–977) was brought to a close by the dissension which resulted in the formation of two separate kingdoms—Judah and Israel—the former comprising the tribes of Judah and Benjamin, to which were afterwards added parts of Simeon and Dan. Jerusalem remained the capital of Judah, whilst that of Israel was eventually established at Samaria. Syria was at first the most formidable enemy of Israel; but later on the weakness of both kingdoms exposed them to the attacks of a more distant and powerful foe. In 721 the ten northern tribes were carried captive to Assyria, their place being taken by colonists, who are supposed by some to have been the ancestors of the Samaritans. After the lapse of 133 years the people of Judah shared the same fate. A decree issued by Cyrus of Persia after his conquest of Assyria restored the tribes of Judah and Benjamin to their former abode (536); but the fate of the ten other tribes has always remained a mystery. During the period of their subjection to Persia, the Jews were governed by a satrap who resided at Damascus, the high priest acting as his deputy at Jerusalem. In 332 Palestine became a part of the Macedonian Empire. On the death of Alexander the Great it passed to the Ptolemies of Egypt, from whom, after perpetual conflicts, it was wrested by the Seleucid monarchs of Syria towards the end of the 3rd

century. The tyranny of Antiochus Epiphanes (170) excited a national rising, led by the Maccabees, who established a theocratic form of government, the high priest exercising political functions. Hyrcanus II., the last of the Maccabæan or Asmonean line, became tributary to Rome in 63, the political power being shared by the Idumæan Antipater, whose son Herod was in 40 B.C. recognised by the Romans as sole ruler of Judæa. On his death, in 2 B.C., his dominions were divided between his three sons. Judæa (comprising the district S. of Mount Ephraim), together with Idumæa on its S. border, and Samaria to the N., was allotted to Archelaus, who assumed the title of ethnarch. Galilee (to the N. of Samaria) and Peræa (occupying the E. bank of the Jordan as far N. as the Lake of Tiberias) fell to the tetrarch Herod Antipas. Herod Philip, also styled tetrarch, ruled in the region E. of the Upper Jordan, including Gaulonitis, Batanæa, Auranitis, Trachonitis, and Ituræa. In 6 A.D. Archelaus was deposed, and his territory was placed under the government of a Roman procurator. The Jews prospered under Roman rule; but they could not endure the yoke of the stranger, and broke out in a fierce insurrection, quelled by Vespasian and Titus (66–70). Soon afterwards the whole of Palestine was incorporated in the province of Syria. After the revolt of Bar-Cochba (136), the treatment of the Jews became even sterner; they were not allowed to approach the walls of their holy city, now a Roman town (*Ælia Capitolina*), with a temple to Jupiter on the site of Solomon's. The religious fervour which characterised the three centuries succeeding the conversion of Constantine manifested itself in Palestine in its most exaggerated forms. The land became the scene of vehement theological disputes; its solitudes were peopled by anchorites, and stones were torn from forts and synagogues to build the monasteries which sprang up on every side. The rule of the monk was brought to a close by the invasion of Chosroes II. of Persia (614), and before Palestine had time to recover from this disaster it fell into the hands of the Saracens (636). El Islâm now became triumphant in the Holy Land, and it was only by abject submission that the Christians were able to purchase a contemptuous toleration. In the 11th century the weakness of the Egyptian Caliphate enabled the Seljuk Turks to add Palestine to their possessions. The insults offered to pilgrims by the new rulers excited the indignation of western Europe, and gave rise to the Crusades. The First Crusade resulted in the formation of the Christian kingdom of Jerusalem, which was organised on the feudal model, with vassal principalities in Palestine and Syria (1099). Within 100 years Jerusalem was taken by Saladin (1187), and, with the exception of the brief period during which it was ruled by the Emperor Frederick II. (1228–44), it has remained in the hands of Moslems ever since. In 1244 the land was overrun by the Chorasmiens; but it was soon afterwards recovered by the Mameluke Sultans of Egypt, who were left in undisturbed possession after the capture of Acre, the crowning catastrophe of the Crusades, in 1291. In 1517 Selim I. added Palestine to his

dominions, and since that date it has formed part of the Ottoman Empire.

Present Condition. Politically, Palestine comprises the four livas of Jerusalem (El Kuds), Nablûs, Acre, and the Hauran, each governed by a mutesarif under the wâli (ruler of the wilayet), who is immediately responsible to the Porte. The settled inhabitants, who number about 620,000, are a mixed race, the descendants of the old Aramæan population and their Saracenic conquerors, but the Bedouins (q.v.) are pure Arabs. Arabic is the language in general use. Religious differences are strongly marked, the Mohammedans, who form about 80 per cent. of the inhabitants, regarding the various Christian Churches with the utmost contempt. There are still settlements of Druses (q.v.) in Galilee and on Mount Carmel. Up to a recent date the Jewish population was almost wholly confined to the four sacred cities—Jerusalem, Hebron, Tiberias, and Safed. The number of Turks is not large; they constitute the official class, and are regarded with an abhorrence which is fully justified by their extortionate government. During nearly four centuries of Ottoman misrule Palestine has been reduced to a state of abject misery. Ruined aqueducts, cisterns, and dwellings testify to the decay into which the country has fallen since the prosperous days of the Romans. Industries which throve in the Middle Ages have been abandoned, and little effort is made to take advantage of the abundant resources of the soil. There are few exports beyond sesamè, fruits, barley, olive-oil, and maize shipped from Acre, Haifa, and Jaffa. An attempt is now being made to open up the country, the chief result so far being the construction of several roads—quite a new feature in Palestine—and also a railway from Jaffa to Jerusalem (opened 1892). The Jewish immigration which has set in of late years continues in spite of Turkish opposition; and German colonies have been planted in the neighbourhood of Ramleh and Jaffa. These and other changes are rapidly altering the aspect of the country and the character of the inhabitants. Meanwhile the expeditions of the Palestine Exploration Fund have supplied the first accurate information regarding the topography and antiquities of the Holy Land. Many lost Biblical sites have been identified, and the eight volumes of the *Survey of Western Palestine* have superseded all older authorities.

Palestrina, GIOVANNI PERLUIGI DA (c. 1524–94), was born at Palestrina, and studied music under Goudimel. In 1551 he was appointed choirmaster of the Capella Giulia in the Vatican, and subsequently held similar posts at the Lateran and Santa Maria Maggiore. The Council of Trent in 1562 condemned the prevailing style of Church music, and Palestrina was invited to assist in reforming it. He had already published his *First Book of Masses*, which marked him as the greatest composer of his day, and in 1565 he produced the famous *Missa Papæ Marcelli*. In 1586 he returned to the Capella Giulia, and afterwards took charge of the choir at the oratory of Philip Neri.

Paley, FREDERICK APTHORP, LL.D., was born

near York in 1816, and, after being educated at Shrewsbury and St. John's College, Cambridge, resided for some time at the university. In 1846 his conversion to Romanism gave a check to his college career, and until 1860 he was engaged in private tuition, which he pursued after his return to Cambridge until 1874, when he was appointed classical professor in the Roman Catholic College established under Monsignor Capel's auspices in London, and examiner in the London University. The great work of his life was textual criticism, which he applied to Æschylus, Sophocles, Euripides, Theocritus, Propertius, Hesiod, Martial, and parts of Homer and Aristophanes. He died in 1886.

Paley, WILLIAM, was born in 1743. He received his schooling at Giggleswick, and, going to Christ's College, Cambridge, came out senior wrangler. Becoming a fellow and tutor, he lectured for eight years on mental philosophy, thus laying the foundations for his great work. His *Principles of Morality and Politics* first appeared in 1785, and was at once adopted as the text-book for ethics at Cambridge. The *Horæ Pauline* followed in 1790. Four years later he produced his *View of the Evidences of Christianity*. He had now been made a prebendary of St. Paul's and rector of Bishopwearmouth and sub-dean of Lincoln. His last ten years were spent in composing, amidst broken health and zealous parochial labours, the work upon which his fame chiefly rests, his *Natural Theology, or Evidences of the Existence and Attributes of the Deity from the Appearances of Nature*. He died in 1805.

Palgrave, SIR FRANCIS (1788–1861), was the son of a stockbroker named Cohen. He assumed the name of Palgrave on his marriage. He published his *Rise and Progress of the English Commonwealth* in 1832. He also wrote various other valuable historical works.

FRANCIS TURNER, LL.D., his son, was born in 1824, educated at Charterhouse and Balliol College, Oxford, and elected fellow of Exeter College. For five years he directed the Kneller Hall Training College, and then entered the Education Department. Mr. Palgrave is known in the literary world as a sympathetic editor and critic. Since 1886 he has filled the chair of poetry at Oxford.

Palinurus, a genus of crustacea including the "Spiny Lobster."

Palissy, BERNARD, was born in Périgord, France, in 1510. By his own unaided efforts he acquired such a knowledge of natural science as was possible in his day, and, having married, settled down to work at his father's trade. He spent sixteen years in finding out the process of enamelling quite familiar to the craftsmen of Italy. At last he was successful, and his vigorously-modelled specimens of earthenware found favour with Catherine de Medici and the Court; but Palissy had adopted Huguenot principles, and so his business was ruined and he himself imprisoned. Charles IX. released him, and gave him a plot of ground—afterwards the Tuileries—as a site for his works. In 1588, however, he again became the victim of fanaticism,

and even Henry III. was powerless to protect him. He was thrown into the Bastille, where he died, in 1589, before his execution could be carried out.

Paliyar, an outcaste tribe, Travancore and Anamalah Hills, South India, are amongst the most degraded of the aborigines of India; of dark red-brown colour, lank hair, scant beard, and savage aspect; speak a rude dialect of the Malayalim (Dravidian) language, and the name, of which there are numerous variants (Pulayer, Puliya, Pulay, Polayer, etc.) is derived from a Dravidian root—*pulu*—meaning “foul.” They are demon-worshippers and omnivorous feeders, but otherwise a harmless, inoffensive people, monogamists, and great hunters, entrapping the tiger or attacking him with poisoned arrows. Till recently those of Travancore, who number about 200,000, were much oppressed by the higher castes, restricted as to dress, compelled to speak of themselves as “slaves,” and conform to other vexatious regulations.

Palladio, ANDREA, born at Vicenza in 1518, devoted himself as a youth to sculpture, which he abandoned for architecture. His genius brought about a reaction against the Gothic style, and he had the ability to adapt ancient forms to modern requirements. The churches of St. Georgio Maggiore, Il Redemptore, and part of the Doge's palace at Venice, and many palaces and villas in northern Italy, are his chief works. His treatise on *Ancient Monuments* is very valuable, but his great work, *I Quattro Libri dell' Architettura* (1570), effected a revolution in taste throughout Europe. He died in 1580.

Palladium, anything which ensures (or is supposed to ensure) safety, the stock instance being the English institution of trial by jury, which is called the palladium of liberty, of the Constitution, etc.; originally an image of the goddess Pallas (Athene), or of Pallas, daughter of Triton, which ensured safety to Troy until Ulysses stole it; then any image or object regarded as a “luck.” Possession of the Trojan Palladium was claimed by Athens, Argos, Rome, and other cities.

Palladium (Pa., at. wt. 106·6), a rare metallic element, which was first discovered in 1803. It occurs in nature in the free state, but not pure, being alloyed with platinum, gold, or iridium. In its general chemical properties it closely resembles platinum. It forms a series of salts, the *palladious* and *palladic* compounds. It has a specific gravity of about 11·8. Neither the metal nor its compounds are much used. An amalgam of mercury is employed in dentistry, and small quantities of the metal are said to improve the quality of steel for many purposes.

Pallas. [ATHENE.]

Pallas, PETER SIMON, born at Berlin in 1741; was invited in 1768 by Catherine II. of Prussia to fill the chair of natural science in the Academy of St. Petersburg. Next year he went with an expedition into Siberia to observe the transit of Venus, and until 1774 was engaged in a systematic investigation of the geography of the empire, extending

his travels to the Chinese frontier. His death occurred at Berlin in 1811. His *Spicilegia Zoologica* is a work of some note.

Palliata, a group of univalve shellfish (Gastropoda) belonging to the suborder Opisthobranchia (q.v.) and including those members of this suborder having a well-developed mantle. The Sea-Hare (*Aplysia*) and the Bubble-shells (*Bulla*) are the two best known representatives.

Pallium, in Roman antiquities, a large rectangular cloak, characteristic of philosophers. In ecclesiastics, a woollen vestment worn by patriarchs, metropolitans, and certain bishops. The original form was a rolled mantle worn as a scarf round the neck, the ends falling in front and behind. In the Greek Church it became a wide scarf, the end of which nearly reached the feet. In the Latin Church it has shrunk to a narrow ring passing round the shoulders, with a short vertical piece falling down the middle of the breast, and the same down the middle of the back. It is ornamented with crosses.

Palma. (1) One of the Canary Islands, lying to the extreme N.W. of the group, is 33 miles long by 15 broad, having the volcanic peak of Roque (8,426 feet) in the centre. The steep sides of the mountains are densely wooded with timber, which is used for shipbuilding, and the lower districts about the coast produce wine, sugar, almonds, fruits, honey, wax. Fish also abounds. Chief town, Santa Cruz.

(2) The capital of Majorca, Balearic Islands, lies in a bay between Capes Blanco and Figuera, on the S.W. coast. A mole half a mile in length enables vessels of large size to discharge cargoes, and is commanded by a fort. The cathedral is a fine Gothic building, begun in 1230, with a graceful spire. The Exchange (1426) has even greater merits, and among other interesting old structures are the Governor's palace, the General Hospital, the town-hall, and the various colleges. Palma is the centre of administration and the seat of a bishopric. A railway now connects it with other chief towns of the island.

Palma, JACOPO, called PALMA VECCHIO, to distinguish him from his grand-nephew, Palma Giovane, was born in 1480. He began to paint early under the influence of the Bellini, but, coming to Venice, is said to have been taught by Titian. His best works are *The Three Graces* in the Dresden Gallery, and six devotional pictures in Santa Maria Formosa at Venice. He died about 1528.

Palmaceæ, a well-defined order of spadicifloral Monocotyledons, called by Linnæus “the princes of the vegetable kingdom,” and comprising over 1,000 species, chiefly natives of the tropics. They have mostly cylindric, unbranched stems, bearing a tuft of large, often gigantic, leathery leaves at the top, the leaves being torn into segments either palmately or pinnately arranged. The flowers are either bisexual or unisexual, and are borne on a spadix which is often branched and is enclosed in a membranous spathe. There is a somewhat inconspicuous greenish perianth of six leaves in two whorls, six stamens, usually three

carpels, and only a single albuminous seed with a small embryo. In some cases, as in *Chamærops humilis*, the only European palm, the stem is short; in others, as in the rattans (q.v.), it is slender, or even climbs by hooked prickles. The leaves are sometimes scattered, and in most cases have a fibrous sheathing base to the leaf-stalk. The terminal leaf-bud is the "cabbage" which, in some species, is eaten. The fruit varies very much, being either a nuculane with a hard seed, as in the date (q.v.), drupaceous (but syncarpous and with a fibrous mesocarp), as in the cocoa-nut (q.v.), or covered with woody reflexed scales, as in the sago-palm. The perisperm of the seed is generally hard and oily, as in the "flesh" of the cocoa-nut; but that of the date, which is mainly cellulose, and that of the vegetable-ivory is still harder. The uses of palms are innumerable. Beams, veneers, canes, thatch, fibre for cordage and matting, fans, hats, bowls, spoons, sago, sugar, wine, spirits, food, oil and wax are only some among the number. The date and the areca-, cocoa-, coquilla- and corozo-nuts are treated separately. *Elæis guineensis* is the African oil-palm, *Sagus Rumphii* the chief of the East Indian sago-palms; the genus *Calamus* yields rattan-canes (q.v.), and *Caryota* (q.v.), palm-wine and Indian gut.

Palmer, EDWARD HENRY, was born at Cambridge in 1840. He evinced a great aptitude for languages, and whilst following the uncongenial occupation of a merchant's clerk contrived to pick up several varieties of speech. Returning to Cambridge in 1859, he was led into Oriental studies, making such progress that he was admitted to St. John's College, and ultimately elected fellow. In 1870 he was employed with Drake in surveying Sinai and the adjoining desert, the result of his travels appearing in *The Desert of the Exodus*. In 1882 Government asked him to go to Egypt and use his influence in pacifying the Bedouin tribes around Suez. Whilst engaged in this service, he and his companions were murdered at Wady Sudr.

Palmer, SAMUEL, born in London in 1805, began as a child to show a talent for painting, and exhibited in the Royal Academy at the age of fourteen. Ill-health having compelled him to leave London, he settled in Kent, where he devoted himself to water-colour painting with great success. The illustrations which he produced for *L'Allegro* and *Il Penseroso* are typical examples of his best style. He died at Reigate in 1881.

Palmerston, HENRY JOHN TEMPLE, VISCOUNT (an Irish peer), was born at Romsey, Hants. in 1784. Educated at Harrow, he succeeded to the title at the age of eighteen, and, after twice unsuccessfully contesting the university of Cambridge, finally obtained, in 1807, a seat for Newport, Isle of Wight. He at once became a Junior Lord of the Treasury in the Tory Ministry of the Duke of Portland, and two years later was appointed Secretary-at-War, retaining this post till Canning's death in 1827, though he never entered the Cabinet until just before that event. After clinging for a few months to Lord Goderich and the Duke of

Wellington, he finally went into Opposition along with Huskisson. He now felt himself more closely drawn to the Liberals than to the Conservatives, and in 1830 took charge of the Foreign Office under Lord Grey. One of his earliest strokes of policy was the creation of the kingdom of Belgium, with Leopold of Coburg at its head. He next used his best endeavours to suppress the Carlists in Spain, and he vigorously supported Turkey against Russian aggression. He resumed office in 1835, and during the next six years brought about the combination of the other Powers against France, and the frustration of Mehemet Ali's schemes in Egypt. From 1841 to 1846 he was once more in Opposition. With some reluctance, he was admitted to his old position in Lord John Russell's Administration, when he supported the premature risings in Italy and Hungary; but in 1851 his irresponsible approval of the *coup d'état* compelled his retirement from office, and he never resumed his control over foreign relations. In 1853 he accepted the Home Office, and on Lord Aberdeen's resignation undertook to form a Ministry. From 1855 to his death, in 1865, he was at the head of affairs, except during a few months of 1858-59, when his complaisance to Napoleon III. as regards Orsini's conspiracy rendered him unpopular. He died almost suddenly in October, 1865. Lady Palmerston, to whom so much of his success was due, survived her husband four years.

Palmipedes. [NATATORES.]

Palmistry, the pretended art of foretelling a person's fortune by the lines, marks, and other characteristics of his palm. It may be doubtful if the professors of this form of divination can even judge of a person's character and habits from their observations.

Palmitin. [PALM-OIL.]

Palm Oil, a vegetable oil which is imported in very large quantities from West Africa, where it is obtained from the fruits of the oil-palm, *Elæis guineensis*. The fruits are crushed and boiled with water; the melted fatty matter rises to the surface and is skimmed off. It forms a dark yellow solid of a buttery consistency, slightly lighter than water (sp. gr. .945), and possessing a peculiar odour. Chemically it consists chiefly of *palmitin*, i.e. a compound of palmitic acid and glycerine, mixed with a little *olein* (q.v.). It may be purified somewhat and bleached by exposing it to a current of steam. It is used in the localities where it occurs as a substitute for butter; in Europe it finds much application in the manufacture of candles and soaps, and as a lubricant for heavy machinery, e.g. axles of railway trains, etc.

Palm Sunday, the Sunday next before Easter, on which Christ's entry into Jerusalem is celebrated, when palm branches were strewn before Him. In former times it was celebrated by a procession, the central figure of which represented Christ riding on an ass. Now many churches are decorated with palm branches on this day.

Palmyra (Hebrew, *Tadmor*; Modern Syriac, *Tidmir*), a ruined city of Asia, situated 150 miles

north-east of Damascus, at one of the rare oases in the Great Syrian Desert. The date of its formation is uncertain. It rose very early to wealth and importance, as the majestic remains of temples, tombs, and dwelling-houses testify. The grandest of these monuments, dedicated to Bel, or the Sun-god, still retains 60 of its 390 columns. The city reached the height of its prosperity during the wars of Rome with Parthia and Persia; but it lost some of its independence in spite of the gallant struggles of Zenobia, after whose defeat (272 A.D.) Aurelian destroyed and depopulated her capital. The Saracens in 740 completed the work of devastation, to which earthquakes have also contributed. It was not until 1678 that the site was discovered by European geographers.

Palpitation, the feeling of distress which is associated with excited action of the heart. In many instances this symptom is occasioned by digestive disturbance. It occurs also as a result of the immoderate use of tobacco, in anæmic conditions, and in Graves's disease. It may be due to disturbed action of the heart consequent upon disease primarily affecting that organ.

Palsy. [PARALYSIS.]

Paludina, the typical genus of the family *Paludinidæ*, one of the best known groups of pond-snails; they belong to the sub-order Prosobranchiata, and began in Upper Jurassic times. The Purbeck marble and the Petworth marble from the Wealden beds of Sussex are both made up in the main of *Paludina* shells; the latter is well known from its use for fonts.

Pamir, the plateau forming a point of union between the mountain-systems of the Tien-shan, the Himalaya, and the Hindu Kush. It is about 1,300 feet above the sea, but the ranges that intersect it are often 1,000 or 2,000 feet higher. Within recent years much interest has attached to the Pamirs, on account of the Russian claims to a portion of it.

Pampangos, a numerous people of Luzon, Philippine Islands, chiefly settled on the great Pampanga plain, north-west of Manilla. Formerly their domain reached to Manilla Bay itself, but here they have been either exterminated or absorbed by the Tagals, whom they resemble in appearance and usages, and even in speech, both speaking dialects of the Malayo-Polynesian language. The Pampangos are the most warlike of all the Luzon tribes, but were reduced, after a stout resistance, by the Spaniards in 1570. At that time a few were Mohammedans, but the great majority Pagans; at present nearly all are Roman Catholics.

Pampas, the name given to vast treeless plains lying south of the forests of the Amazon valley. They are for the most part covered with grass and enormous thistles, and herds of wild cattle and rodents called biscachas abound. [GUACHO, VAQUERO.]

Pampeluna, or PAMPLONA, the capital of Navarre, Spain, is situated on the river Arga, 200 miles

north-east of Madrid, the plain, in which it occupies an elevated point, being surrounded by mountains. Its name and foundation are ascribed to Pompey. Charlemagne captured it in 778, and it has played a part during the Peninsular War and the more recent Carlist movements. Besides its walls, it has two castles, one of which, the citadel, stands on a sheer rock 1,000 feet high. Among other public buildings, it possesses a cathedral, a governor's palace, a fine aqueduct, and one of the largest bull-rings in Spain.

Pamphlet, a short literary work consisting of one sheet or a few sheets stitched together, but not bound, sometimes with a paper wrapper. The news-books of the 16th and 17th centuries containing news-ballads and verses on topics of the day were called pamphlets. Political pamphlets were much commoner than they are now before the development of regular journalism.

Pan, in Greek mythology, was the god of the country, and in later times of all nature, and his parentage was ascribed to Hermes, Zeus, or Apollo, and Callisto or Ænoë. He was represented as possessing the lower limbs of a goat, horns on his head, and half-human features. His voice inspired terror; hence the derivative "panic." Arcadia was the chief seat of his worship, and there he was supposed to wander on the mountains in the company of the nymphs and satyrs, playing on the pipes and dancing. Prophetic powers were attributed to him, and he promoted the fecundity of the flocks and herds.

Panama, the name of the most northerly state of South America, of its capital city, and of the isthmus connecting the two great continents of the western hemisphere. The state forms part of the Confederation of Colombia, and has an area of about 32,000 square miles, its Atlantic coast-line being 420 miles, whilst that on the Pacific side extends for 650 miles, and includes the fine bay of Panama. A mountainous ridge of no great elevation runs through the centre, parallel with the coasts, and forms the watershed of the Chagres river, flowing east, and the Rio Grande, flowing west. The flat country near each shore is marshy and very unhealthy, but produces an abundance of tropical fruits and vegetables. Cotton, indiarubber, and tobacco, vanilla, sarsaparilla, etc., are exported. The chief cities besides the capital are Colon (Aspinwall), the Atlantic port, Santiago, Penonomé, and Los Santos. The Isthmus is practically identical with the state, though the name is sometimes made to embrace the isthmuses of Darien and San Blas. Its breadth from Colon to Panama is about 40 miles, and a railway connecting these two points was completed in 1855 by an American company. The idea of a canal was mooted as early as 1520, but it was not until 1875 that any practical steps were taken. Four years later M. de Lesseps threw his energies into the languishing project, but the result was disastrous failure. M. de Lesseps, his sons, and several co-directors and deputies were, in 1893, put upon their trial for fraud and corruption, convicted, and sentenced to severe penalties, soon afterwards

remitted. The city of Panama was founded in 1518, and is the oldest European settlement in America, but few traces of the old Mauresque Spanish architecture remain. The cathedral dates from 1760, and was much injured by earthquake in 1882. Most of the other churches and convents are more or less in ruins. Among other public edifices are the residences of the president and governor, the House of Assembly, a college, and the Convent of the Concepcion. The harbour is safe, but ships of any draught have to anchor three miles from the quay. It is a free port.

Panchatantra, a Sanskrit "pentateuch" of moral stories to which the Hitopadeśa (q.v.) is largely indebted.

Pancras, ST., or PANCRACTIUS, a Roman youth of noble family who suffered martyrdom under Diocletian about 304 A.D., at the age of fourteen. In early times he shared with St. Nicholas the patronage of boys. He is usually represented trampling on a Saracen and bearing either the martyr's palm or a sword or stone.

Pancreas. The pancreas is a gland which is situated in the abdominal cavity in close relation with the duodenum; the pancreatic duct discharges its contents into that portion of the small intestine some two or three inches from the pyloric end of the stomach. The pancreas is a long narrow structure having an expanded head at its right extremity. It presents some resemblance, when examined microscopically, to a salivary gland. (For the function of the pancreatic juice in digestion, see article on that subject.)

Panda (*Ailurus fulgens*), the single species of the genus *Ailurus*, of the Raccoon family. This animal, a little larger than a cat, found high up in the Himalayas, is a vegetable-feeder and partially nocturnal. The fur is reddish-brown, and the long tail is ringed with yellow and red.

Pandora, a character in Greek mythology. Zeus, to punish Prometheus for his creative efforts, got Hephestus to make a beautiful female figure, which was then endowed with life and loaded with gifts from all the gods. Lastly, Zeus himself gave her a box as a dower, and sent her to Prometheus for a wife. The latter was too shrewd to be taken in by the artifice; but Epimetheus, his brother, yielded to Pandora's charms and to hope of gain. No sooner was the box opened than all the ills of mortal life escaped from it and spread over the world, but hope was still left at the bottom.

Pangenesis, a hypothesis put forward by Darwin in 1868 in his *Variation of Plants and Animals under Domestication* to explain the facts of heredity. It supposes all the cells of an organism to throw off inconceivably minute gemmules, which multiply by self-division and are capable of developing into cells similar to those from which they are derived. By mutual affinity these gemmules are collected into the sperm-cells and germ-cells of the organism, so that the offspring of the union of sperm and germ combines gemmules from all parts of each parent's body. A large number of gemmules

are supposed to be transmitted in a dormant state to future generations, thus explaining the phenomena of reversion or atavism. This hypothesis has been opposed by that of Mr. Herbert Spencer, of physiological units, and by Professor Weismann's hypothesis of "the continuity of the germ-plasm." [WEISMANN.]

Pangolin, any individual of the Edentate genus *Manis*, with several species, from the Oriental and Ethiopian regions. They are long slenderly-built animals, with short limbs, and covered with imbricated scales generally brown in colour, whence they are called scaly ant-eaters. They can roll themselves into a ball, and the scales pointing outwards form an efficient protection.

Panipat, an ancient ruined city in the Karnal district of the Punjab, India, 53 miles N. of Delhi. Its origin is traced to the mythical period of the Mahabharata; but in more modern times it is celebrated as the scene of three battles that are turning-points in Indian history—viz. Baber's victory in 1526, Akbar's final assertion of Mogul power in 1556, and the blow that was dealt to the Mahratta supremacy by Ahmed Shah Durani in 1761. The modern town, standing high on the old bank of the Jumna, with the *débris* of former buildings as its foundation, is a poor and squalid place.

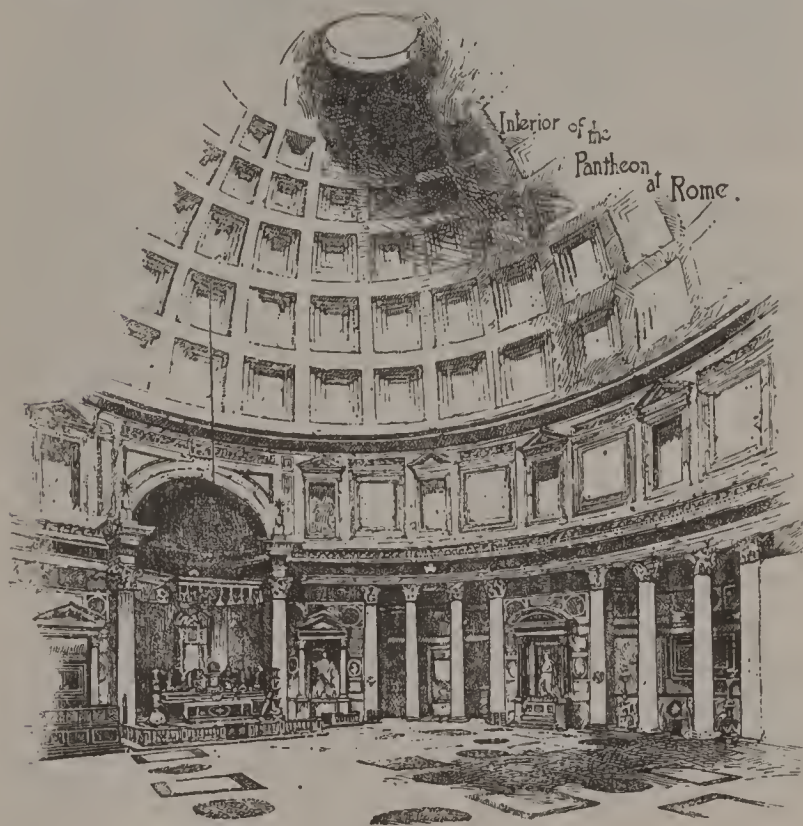
Panizzi, SIR ANTHONY or ANTONIO, was born near Modena in 1797, and educated as an advocate. Implicated in the revolutionary movement of 1821, he had to escape from the Continent, and, coming to England, settled as a teacher at Liverpool. An introduction to Brougham led to his appointment as Italian professor in University College, London (1828), and as extra assistant librarian in the British Museum (1831). Twenty-five years later he succeeded to the principal librarianship, but he had in the meanwhile, as keeper of printed books, designed and carried out the reading-room and had vastly enriched the collection under his charge. Before his retirement in 1866 the museum officials were recognised as civil servants, and the removal of the natural history collections to South Kensington provided for. He was made K.C.B. in 1869, and died in 1879.

Panjâbi, a neo-Sanskritic language current throughout the province of Panjâb, North-west India, where it is spoken by about 16,000,000, chiefly Sikhs (q.v.); two main branches—*Dogri*, of the lower hills between the Upper Chenab and Jhelum river, south of Cashmere, and *Multani*, with Sindhi affinities, about the lower course of the Indus. Panjâbi is closely allied to Hindi, but is largely charged with Persian and Arabic elements, and is written with the Gurumukhi alphabet, a modernised form of Devanagari, with 35 letters.

Pannonia, a province of the Roman Empire, lying south of the Danube and north of Dalmatia and Mœsia Superior, and corresponding to S.W. Hungary and parts of Lower Austria, Styria, and Carniola, with Croatia and Slavonia. It was first subjugated in 8 A.D., and the legionaries stationed there rebelled in 14 A.D. and were quelled by Drusus. Under Trajan the province was divided

into Pannonia Superior and Pannonia Inferior. Diocletian substituted a fourfold division including Valeria and Suavia. Vindobona (Vienna) was the chief city of Upper Pannonia, and Sirmium (Mitrovic) in Lower Pannonia often served as a residence of the later emperors. The Huns wrested the province from Theodosius: it was afterwards overrun by Ostrogoths, Longobards, and Avars.

Panorama, a painting of a complete scene, viewed from a central point or made continuous



INTERIOR OF THE PANTHEON AT ROME.

upon an unrolling canvas. The former variety is very popular, verisimilitude is given by introducing lay-figures, etc., in the foreground, the spectator standing on a central platform some little distance from the canvas.

Panslavism, a movement for the political union of *all Slavonic* nationalities [SLAVS] under the leadership of Russia or a re-united Poland.

Pansy (from the French *pensée*, "thought"), is one of many popular names for *Viola tricolor*. As Ophelia says in *Hamlet*, "And there is pansies—that's for thoughts." Milton, in *Lycidas*, speaks of "the pansie streaked with jet." Other names are Heart's-ease, Love-in-idleness (*Midsummer Night's Dream*, act ii. sc. 2), and Three-faces-under-a-hood. This species, of which the cultivated varieties are endless, is remarkable for the large pinnately-lobed stipules to its leaves, the varied colours (q.v.) belonging both to the xanthic and the cyanic series, combined in its petals, and the absence of the cleistogamous flowers which are present in the violet (q.v.). *V. tricolor* is a common weed in cultivated ground.

Pantagraph. [PANTOGRAPH.]

Panthalops. [CHIRU.]

Panthay (PANSI), collective Burmese name of the Mohammedans of Yunnan, South-west China,

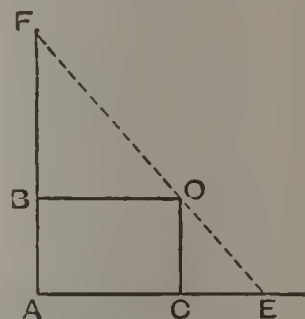
either from *Pun-tai* = "oldest people," "aborigines," or a corrupt form of *Parsi*, a term still often applied to the Moslem population of India. They are the *Hwai-tze* of the Chinese, and claim Arab descent, although they migrated in the 17th century from North China (Kan-su and Shensi) to Yunnan. The features often betray both Arab and Tatar characteristics, and as a rule they are much taller, stronger, and more vigorous than the Chinese proper. The name is now commonly applied to all Chinese Mohammedans, who number altogether about 20,000,000. (De Thiersant, *Mahométanisme en Chine*, 1879.)

Pantheism, the theological and metaphysical doctrine that God is one and the same with the sensible and material universe, and consequently impersonal.

Pantheon, a temple or other sacred building dedicated to all gods. The most famous is the Pantheon in Rome, built B.C. 25 by Augustus minister, Agrippa. It is a circular domed structure, with an octastyle portico of Corinthian columns. Since 607 it has been used as a Christian Church, being dedicated to the Virgin Mary and all the martyrs. It is one of the finest and best preserved relics of antiquity.

Panther. [LEOPARD.]

Pantograph is an instrument for reproducing a drawing on a different scale from the original. A very usual form of it consists of four rods, A F, A E, O B, O C, jointed at B A C O. Points E and F are chosen (according to the requirements of the drawing) such that E O F is a straight line. The point O is fixed and, however the parallelogram may be moved, the ratio of O E to O F is unaltered, since it is equal to the fixed rate EC/CA. If a pointer be fixed at E and made to travel over a drawing, a pencil at F will trace out an exactly similar drawing, the linear dimensions of the two drawings being in the ratio of E O/O F.



PANTOGRAPH.

Pantomime, originally a stage-player who acts in dumb show; then a drama acted in dumb show; now a theatrical entertainment (performed during the Christmas season) consisting of two parts—the first a burlesque of some popular fable, and the second the tricks of the clown and pantaloons, and dancing of harlequin and columbine; the second part, or harlequinade, being ushered in by a transformation scene.

Paoli, PASQUALE DE, the son of a well-known Corsican patriot, was born in 1725 at La Stretta, in Corsica. In 1738 he accompanied his father to Naples, got a military education, and served with distinction in Calabria. Returning to his native land in 1755, he was chosen generalissimo in the struggle first against the Genoese and then against the French. The latter, under Count Vaux, utterly

defeated the patriots in 1769, and Paoli escaped on board an English frigate. Whilst residing in this country he received a pension of £1,200 a year from the Government and made many friends, Dr. Johnson being among their number. After the Revolution he accepted the governorship of Corsica under the republic; but in 1793 rose with British aid against the Convention, and, having proclaimed George III. king, again came to England, where he died in 1807.

Papagos (PAPAHOTAS), a numerous people of North Mexico, about the head of the Gulf of California, between the Altar and Gila rivers; are of Pima stock, very tall and vigorous, with fair complexion, no darker than that of South Europeans. The Papagos are chiefly stock-breeders and fishers, of peaceful disposition, and strict monogamists, treating their women with great respect. Many migrate periodically across the frontiers, seeking employment in the mining districts of Arizona, where the United States Government has lately assigned them a reservation 120 square miles in extent. These number about 5,000, and are all nominal Christians.

Papaveraceæ, the poppy tribe, a natural order of Thalamifloræ (q.v.) containing about one hundred species in nearly twenty genera. They are sometimes shrubs, but mostly herbs with abundant milky or coloured latex of a narcotic character. The leaves are scattered and exstipulate; sepals, two and caducous; petals, usually four and hypogynous; stamens, numerous; fruit, dry and usually capsular, with numerous seeds on parietal placentas. Besides the genus *Papaver*, the order includes *Chelidonium*, the Celandine, and the Californian *Eschscholtzia*.

Papaw (*Curica Papaya*), a tropical South American tree, the type of a small calycifloral order (*Papayaceæ*). It seldom exceeds twenty feet in height or a foot in diameter, and is often hollow. It bears scattered leaves on horizontal stalks often two feet long, and themselves sometimes two feet across and deeply seven-lobed. The flowers are diœcious and pentamerous, and the gourd-like fruit is about ten inches long, melon-shaped or oblong, and of an orange colour. It is edible, but when ripe is seldom eaten raw. The whole plant contains an acrid milky juice, and possesses the interesting property of rendering meat tender. It contains an essential principle, *papayin*, analogous to the animal ferment trypsin, and is successfully employed in dyspepsia, diphtheria, etc.

Paper is manufactured, on the principle of felting, in thin sheets from fibre of linen and cotton rags, of straw, rice-straw, and of various woods and grasses. The fibre is variously prepared, and reduced to fluid pulp, which is run into trays in a sheet or film, pressed between rollers, and dried. Paper has very largely superseded as a material for writing purposes bark, papyrus (q.v.), parchment (q.v.), and vellum (q.v.).

Paper Nautilus, a Cephalopod belonging to the sub-order Octopoda, and of interest as the

females have a delicate, one-chambered shell. This is secreted by two of the arms which are expanded into a membranous plate, which are closely attached to the hinder part of the body; the shell is therefore "pedal," and not, as in ordinary shell-fish "pallial"—i.e. secreted by the mantle. The Paper Nautilus lives on the open seas in the warmer parts of the world, and it was believed to use the two expanded arms as sails; the fact that the shell is keeled further helped to this delusion. The only fossil forms occur in the Pliocene deposits. The generic name is *Argonauta*.

Paphos, the name of two cities in the south-west of Cyprus. At Old Paphos (Kykliā) was a celebrated temple of Aphrodite, whom Homer makes to land here after she sprang from the foam. At New Paphos (Baffa) St. Paul preached and struck blind Elymas the sorcerer. The latter is on the coast, the former two miles inland.

Papias, Bishop of Hierapolis in Phrygia, died about the year 162. Between 140 and 150 he put together a collection called *Expositions of Sayings of the Lord*, fragments of which are preserved in the *Historia Ecclesiastica* of Eusebius. They appear to have been founded on oral tradition derived from the daughters of Philip the Apostle and from Polycarp, who had been a disciple of St. John.

Papilionaceous, or BUTTERFLY-LIKE (from the Latin *papilio*, "a butterfly"), is the term applied to the corolla characteristic of a large sub-order of the order Leguminosæ (q.v.), including all our British species of peas, vetches, clovers, etc. Such a corolla consists of five petals, the odd posterior one, known as the *standard* or *vexillum*, being generally relatively large, erect, and exterior. It overlaps two lateral petals, the *wings* or *alæ*, and they in turn overlap the two anterior and generally horizontal *keel-petals* or *carinæ*, which are often confluent towards their apices. The petals have claws, are curiously interlocked or modelled over one another, and often differ in colour.

Papilionidæ, a family of butterflies in which all three pairs of legs are perfect; it is divided into two sub-families, the *Pierinæ* and *Papilionidæ*. The best-known species are the wood-white (q.v.), the white cabbage butterflies (q.v.), and the swallow-tailed butterfly (q.v.).

Papillæ. [SKIN.]

Papin, DENIS (1647–1715), French physicist, was born at Blois. He practised as a physician before turning his attention to science, but was compelled to leave France on the revocation of the Edict of Nantes. After living some years in England, where he was intimate with Boyle, he was in 1688 appointed professor of mathematics at Marburg, and died there. Besides being the inventor of a machine for raising the temperature of water above 212° F. (which is called by his name and known as his digester), he improved the air-pump, and was probably the first to construct a steam-engine.

Pappenheim, GOTTFRIED, GRAF VON (1594-1632), an Imperial General in the Thirty Years' War, came of an ancient Swabian family, whose head was hereditary Marshal of the Empire. He first took service under the king of Poland, but made his reputation by his cavalry charges in the Thirty Years' War. To him the early victory of Prague (1620) was mainly due, and the suppression of the Austrian peasants' rising of 1626; but his rashness was more than once fatal to Tilly, and his Catholic zeal led to the cruel sacking of Magdeburg in 1631. He did good service under Wallenstein at Lützen, where he was mortally wounded, but lived to hear of the death of Gustavus Adolphus.

Pappius of Alexandria, a mathematician who lived probably in the 3rd century A.D., was author of a *Mathematical Collection*, from which most of our knowledge of Greek geometry is obtained. The work contains theorems, some of which were worked out by Pappius himself, but its interest is mainly historical.

Pappus, a circlet of hairs taking the place of the limb of the calyx (q.v.) in many Compositæ (q.v.) and some allied orders of plants. In the dandelion it is *stipitate* or stalked, being carried up on a tubular prolongation of the receptacle. In the salsify it is *sessile*. In the former case the hairs are unbranched or *pilose*; in the latter, and in thistle-down, they are feathery or *plumose*.

Papuans, collective name of the eastern or Oceanic division of the Negro race, separated by the Indian Ocean from the western or African division; derived from the Malayan word *papûvah* ("frizzly"), in reference to the "mop heads," which are highly characteristic of all the dark Oceanic peoples. In its widest sense, the term "Papuan" comprises the Papuans proper of New Guinea and neighbouring islands; the so-called "Alfuros" or Western Papuans of the Malay Archipelago, between New Guinea and Floris; the Melanesian or Eastern Papuans, between New Guinea and Fiji, and south to New Caledonia; the Negritoës of the Philippines, Malay Peninsula, and Andaman Islands; the extinct Tasmanians and the Australian aborigines, of aberrant type. [AUSTRALIANS, MELANESIANS, NEGRITOËS.] Owing to long contact especially with the Malays and Indonesians (Brown Polynesians), even the Papuans proper must at present be regarded as an extremely mixed race almost everywhere except in the interior of New Guinea and of the other larger islands, where the original type has been preserved in comparative purity. In general this type is of a less pronounced Negro character than that of the African division; the colour is somewhat lighter, the hair is never woolly in the strict sense, but always frizzly; the nose much larger, rather arched than depressed, with a downward tip at the base; the lips much thinner and less everted; the cheek-bones less prominent, jaws less prognathous, and features altogether less coarse and softer; lastly, stature considerably shorter, averaging about 5 ft.—a little more in the men and a little less in the women. The Papuan

is, therefore, a Negro toned down, so to say, the modified forms being probably attributable to the different climatic conditions—marine in the east, continental in the west. In speech there is no kind of resemblance, the less so that many Papuans (especially the Melanesian branch) have for ages spoken Malayo-Polynesian dialects of even more primitive form than those of the modern Malays and Polynesians themselves (Codrington). The true Papuan languages, such as those of the interior of New Guinea and of the Aru Islands, have scarcely yet begun to be seriously studied; but enough is known of their structure to separate them altogether both from the Malayo-Polynesian and from the African linguistic families. The Papuans resemble the African blacks perhaps more in their mental than in their physical qualities. Both are equally excitable, laughter-loving, boisterous, and improvident; both good agriculturists (the plantations on parts of the New Guinea seaboard are models of their kind), and endowed with considerable artistic taste, as shown especially in their wood-carvings; both also cruel, indifferent to human suffering, and pronounced cannibals, at one time, perhaps universally, even still to a large extent. On the other hand, the Papuans are no believers in witchcraft, and altogether less superstitious, but more treacherous, owing probably to the prevalence of the vendetta. Their social organisation also is less developed, and although certain individuals may enjoy more or less influence due to their personal qualities, there are no tribal chiefs proper, either hereditary or elected. (G. W. Earl, Dr. Hamy, Beccari, d'Albertis, A. B. Meyer, Miklukho-Maclay, Rev. G. Brown, Rev. W. G. Lawes, A. R. Wallace.)

Papules are minute prominences met with in some forms of skin disease. Some cutaneous affections remain papular throughout—*e.g.* lichen. In other cases the solid papule is the first stage in the development of what becomes a vesicle, and it may be finally a pustule. The hard, shot-like elevations met with in the early stages of small-pox are examples of this last-named variety.

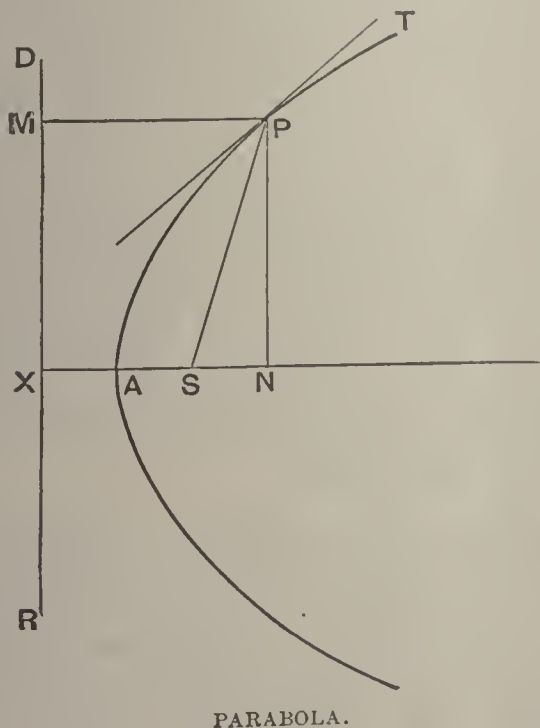
Papyrus (from the ancient Egyptian *Papu*), is the Greek and Latin name of the sedge *Cyperus Papyrus*, probably the "bulrush" of the Bible, which, though used for boat-building, cordage, and sails, is chiefly interesting as perhaps the oldest of paper-making materials. The plant is perhaps indigenous in Nubia and Abyssinia, but was largely cultivated in the Nile delta. Some Egyptian papyri date from upwards of 2,000 years B.C. The plant has a horizontal rhizome, which spreads in the mud, sending up stems eight to ten feet high. Pliny describes how the paper was made from these stems by cutting them in longitudinal slices, placing them side by side with others across them, wetting them and beating them with a mallet. It continued in use down to the 10th century A.D. The plant, extinct in its wild state in Egypt, grows wild near Syracuse, where it was probably introduced by the Saracens.

Para, or BELEM, a port of Brazil, is the capital

of a state of the same name, which is watered by the lower courses of the Amazon, and has an area of 443,000 square miles. The town stands at a point where the Capim enters the estuary of the Rio Para. It is surrounded by forest, and has a harbour which admits large vessels. It is the headquarters of the Amazonian Steamboat Company, and from it the towns along the Amazon are supplied with imported goods. Indiarubber, Brazil-nuts, cacao, and other products are exported.

Parable, an allegorical representation or story from which a moral is drawn. The parable is a fictitious story, but differs from the apologue in that it deals with events which might reasonably and naturally have happened. In the English Bible it also means a proverb.

Parabola is the curve obtained when a cone is cut by a plane parallel to any one of its generating lines. If the plane pass through the apex of the cone, then the curve obtained will be simply one of the generating lines; hence a straight line may be considered as the limiting case of a parabola. Besides being regarded as the section of a cone, a parabola may also be defined as a curve such that the distance of every point on it from a fixed point (the *focus*) is the same as its perpendicular distances from a fixed straight line (the *directrix*). If S is the focus, DR the directrix, and SX perpendicular to DR , then A , the middle point of SX , is a point on the parabola, and is called the *vertex*. If P be any other point, and PM be drawn perpendicular to the directrix, then $\frac{SA}{AX} = \frac{SP}{PM} = 1$. The line AS produced is the *axis* of the parabola, and, since $\frac{SA}{AX} = 1$, it follows that the curve can only cut this axis again at a second vertex infinitely far off. The point halfway between the two vertices

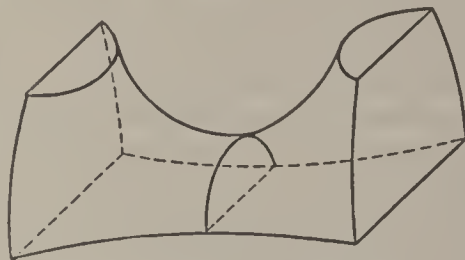


PARABOLA.

(the *centre*) is hence also at infinity, so that a parabola may further be regarded as an ellipse whose centre and second vertex are at infinity. Since all diameters of a conic pass through the

centre, the diameters of a parabola must meet at infinity—i.e. they are all parallel and parallel to the axis, the latter being often called the principal diameter. If a tangent, TP , be drawn at P , the angle $TPM = \text{angle } TPS$, and from this property follows a neat method of cutting out a parabola. Let a sheet of paper be taken with one edge quite straight, and a short distance from the centre of this edge let a small pin-hole be pricked. Let the paper now be doubled over so that the edge crosses the pin-hole in any direction. After repeating this for a number of directions and firmly pressing down the paper each time, it will be found that the creases trace out a parabola; they are, in fact, so many tangents, and if a good number have been made the curve can be easily cut out. If PN be the perpendicular from P to the axis it can be proved that $PN^2 = 4AS \cdot AN$. This gives the equation of a parabola as $y^2 = 4ax$, the vertex being taken as origin, and AS produced as the axis of x . All curves whose equations are of the form $y^n = bx^m$ are known by the general name of parabolas, the curve $y^3 = bx$, for example, being called the cubic parabola.

Paraboloid is a solid figure in which parabolic sections can be cut. If a parabola be rotated about



HYPERBOLIC PARABOLOID.

its axis, it will give the *paraboloid of revolution*, the sections at right angles to the axis being circles. Should these sections be ellipses instead of circles, we have the *elliptic paraboloid*. A more complicated surface is the *hyperbolic paraboloid*, the sections in planes parallel to two pairs of axes being parabola, and those in the plane containing the third pair of axes being hyperbolae. The surface so obtained is saddle-shaped, and extends to infinity in the direction of each of its axes. Although so curiously curved, it is possible to draw straight lines upon it; hence it is called a ruled surface, and may be constructed by suitably arranging a number of stretched strings.

Paracelsus, whose real name was THEOPHRASTUS BOMBASTUS VON HOHENHEIM, was born in the last decade of the 15th century. After leaving Basel University, he studied chemistry and alchemy with Bishop Trithemius of Würzburg, and afterwards made practical observations in the mines of the Tyrol. After wandering all over the Continent he, in 1526, settled at Basel as town physician, having acquired a great medical reputation. In two years' time he, however, left the town, having made enemies by his personal peculiarities, as well as by lecturing in German (instead of the orthodox Latin) and by expressing contempt for Galen and other traditional medical authorities.

For the rest of his life he wandered from town to town in the south of Germany, finally settling in Salzburg, where he came to a sudden end. Numerous works were attributed to him for many years after his death, but of these only a small number are now considered genuine. His *Practica* was printed at Augsburg as early as 1529.

Parachute, an apparatus for enabling a person to descend safely from a balloon, usually in the form of an umbrella, with a diameter of between twenty and thirty feet. The resistance of the air first opens the parachute, on to which the aéronaut hangs below, and then checks its descent.

Paradise Fish (*Macropodus viridi-auratus*, Lac.), a Chinese fish, of brilliant coloration, which breeds readily in aquaria. The ventral fins and lobes of the tail are prolonged into filaments. The name is also applied to an allied species, *Osphromenus olfax*.

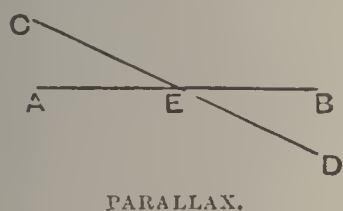
Paraffins (Lat., *parum*, little; *affinis*, like). The name paraffin was first given to a waxy substance which was obtained from the tar resulting from wood distillation. This substance, however, as well as certain liquids obtained naturally or by artificial means, was found to consist chemically of a mixture of hydrocarbons all intimately related to one another, and to which the name was then given as a generic term. Hence the paraffins are hydrocarbons which may be represented by the general formula C_nH_{2n+2} . They vary considerably in characteristics, from the gas methane (q.v.) CH_4 , to higher solid members in which the number of carbon atoms may be as many as sixty. They all are incapable of uniting directly with other substances to form addition-compounds, and are hence termed *saturated* compounds. They give rise by substitution of hydrogen to a very large number of compounds of different types, as acids, alcohols, etc. The paraffin wax and oil both consist of mixtures of these compounds. That used for illuminating purposes is a thin liquid obtained by the distillation of natural petroleum (q.v.), or from carbonaceous shales. During this process a number of oils are obtained, which have to be separated to some extent by fractional distillation. The more volatile portions, which are not suitable for illuminating purposes, are very largely employed as solvents for organic products—*e.g.* caoutchouc, resins, etc. The next portion of the distillate is used extensively for lamps and as fuels. The higher boiling portions cannot be well used in lamps, but find application as lubricants, and to an extent also as fuel, while the last parts which are solid at ordinary temperatures are employed in the manufacture of candles, usually mixed with stearin, as otherwise the candle is of too soft a consistency.

Paraguay. A South American republic, has Bolivia on the N. Brazil on the E., and the Argentine Republic on the S. On the W. is the country called "El Gran Chaco," and the boundary on this side is somewhat indefinite. Paraguay, which is divided into two parts by the river from which it is called, has an area of about 140,000 square miles. Discovered by Juan Diaz da Solis in 1515, it was

further explored by Diego Garcia and Sebastian Cabot. The aborigines long resisted the Spanish, but by the middle of the 16th century Paraguay had become a province of the viceroyalty of Peru. Later the Jesuits arrived, and in the following century the whole administration of the country was given over to them, with the happiest results. In 1768, when they were expelled, Paraguay again came under the Spanish viceroys, until in 1810 it declared itself independent. From 1814 till 1840 the government was carried on by Dr. Francia (q.v.), and from 1844 to 1862 by his nephew, Don Carlos Lopez. The latter's son, Don Francisco, perished in 1870 in the disastrous war with Brazil and the neighbouring states, by which the population of Paraguay was decimated. The northern part of the country consists of grassy plains, on which are many palm-trees, alternating with low ridges. In the fertile south are savannahs and rich marsh land with some well-wooded hill country. The climate is temperate. In the north country grows the maté, or Paraguay tea-shrub; and india-rubber and dye-wood, oranges, several species of gums, cochineal, honey, and various medicinal plants are among the natural productions. Maize, tobacco, rice, coffee, cocoa, and the sugar-cane are cultivated; and valuable timber is obtained from the forests. The result of the war of 1865–70 was the formation of a national debt, chiefly due to English creditors. Though it was repudiated in 1874, a settlement was arrived at in 1885. Tanning and the pottery manufacture are carried on by the natives, but trade in the towns is in the hands of foreigners. The religion of the country is Roman Catholic. Although education is compulsory and gratuitous, but a small proportion of the Paraguayans can read and write. At the close of the war a new constitution was enacted, by which the executive was given to a president elected for four years, and the legislative power was vested in two houses. Asuncion, the capital, and Villa Rica are the only important towns. Immigration from Europe has repaired some of the losses caused by the war, and between 1880 and 1890 the commerce of the country doubled. The river Paraguay rises in the state of Matto Grosso in the west of Brazil, and thence flows southwards along the borders of Bolivia, through Paraguay, and into the Argentine Republic, where it becomes one with the Paraná. It enters the sea at Buenos Ayres after a course of some 1,800 miles. The Paraguay was declared open to all nations in 1852, and is navigable by steamers as far as the mouth of the Cuyaba, one of its chief affluents.

Parallax is the apparent alteration in the position of an object caused by a change in the position of the observer. Thus, if an object at E be viewed from the point A, it appears to be in the direction E B; but, if it be viewed from C, it appears to be in the direction E D. The angle C E A is the parallactic angle, and measures the amount of parallax. The determination of parallax is of great importance in astronomy. The places of the moon and planets seen from the centre of the earth are known as the true places of these bodies; but, since

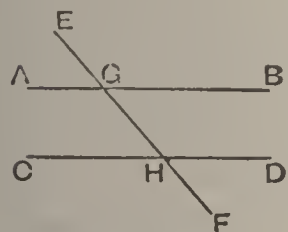
no observations can be actually made from that convenient point, corrections have to be applied to the observations made from the earth's surface. In the above diagram let E represent a planet, A a point on the earth's surface, and C the centre of the earth. B D will be the arc of a great circle, and is called the diurnal or geocentric parallax. It is, of course, equal to the angle between A and C viewed from the planet. The diurnal parallax of a planet is greatest when the latter is on the horizon, and is then known as the horizontal



PARALLAX.

parallax, this being equal to the angle which the radius of the earth subtends at the planet. A result of diurnal parallax is that the planets appear lower in the heavens than they really are; hence at rising they appear to the east of their true place, and at setting, to the west. The nearer a heavenly body is to us the greater is its parallax. The fixed stars, being so very far away, have no diurnal parallax, so that this phenomenon is limited to the sun, moon, and planets; but it was observed by the astronomer Bessel that the position of some of the stars did appear to alter at different times of the year—*i.e.* when viewed from different points of the earth's orbit. This alteration is known as the annual parallax of a star, and is equal to the angle subtended at the star by a radius of the earth's orbit. To avoid any errors caused by this, it is found convenient to calculate the positions of the stars as though they were viewed from the sun and not from the earth. Hence this parallax is also known as the heliocentric parallax. In very few stars, however, has any annual parallax been observed, the greatest being that of the star α Centauri, and even in this case it does not amount to 1". This star has therefore been considered as the one nearest to the earth; but the distance is more than two hundred thousand times the earth's distance from the sun.

Parallel. In Euclidian geometry two straight lines are said to be parallel when they are in the same plane, and on being produced both ways, never meet. Modern geometry, however, prefers to consider that they meet at infinity. Euclid's theorems in his investigation of parallel straight lines have been criticised by the ablest mathematicians, with the result that it has been found impossible to either prove or disprove the assertion that, "when two lines are cut by a transversal, if the alternate angles are unequal the lines meet." This was assumed as true by Euclid,



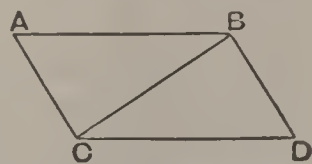
PARALLEL.

and from this it followed that if the lines are parallel the alternate angles are equal. If EGHF be the transversal to the lines AB and CD, Euclid's assumption is that AB and CD meet if EGB and GHD are not equal, or, as Euclid states it, if the sum of BGH and GHD is less than two right angles.

Parallelepiped is a solid figure, all of whose six sides are parallelograms, from which it follows that its edges consist of three sets of four parallel lines. Its three diagonals—the lines joining opposite corners of the figure—meet at a point and mutually bisect each other. The most commonly occurring form of parallelepiped is bounded by rectangular parallelograms, and is exemplified by an ordinary cigar-box; this is called a rectangular parallelepiped. Among crystals are found numerous examples of different parallelepipeds, calc spar, for instance, occurs naturally in that form of it which is known as a rhombohedron. When all the faces are squares, the parallelepiped becomes a cube.

Parallel Motion was invented by Watt as part of his steam engine. In a beam engine the end of the beam moves in a circular path, while the piston-rod, whose motion must be transmitted to it, moves in a straight line. If the beam and piston-rod were connected by a single link, the horizontal component of the circular motion of the former would produce great pressure on the stuffing-box, and tend to bend the piston-rod. To overcome this, Watt connected the beam and piston-rod by three links pivoted together and to the beam, making a parallelogram of which one side was a portion of the beam, the piston rod being pivoted to one corner. By the addition of a "radius rod" pivoted to the lower corner of the parallelogram, and also to a fixed point on the framework of the engine, and by properly proportioning the lengths of the links, the piston rod can be constrained to move in a straight line. Various parallel motions have been designed to suit different patterns of engines; but, as the beam engine is now practically obsolete, they are no longer required. Parallel motions are, however, used in some pieces of mechanism, such as the steam-engine indicator.

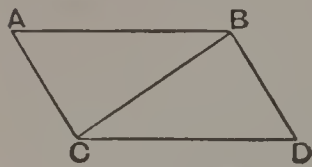
Parallelogram of Forces follows from Newton's second law of motion (q.v.). If two forces acting at any point B may be represented in magnitude and direction by the lines BA, BD, and if the parallelogram ABCD be completed, its diagonal BC will represent in magnitude and direction the resultant of those two forces. This proposition can also be deduced from the parallelogram of velocities (q.v.), since a force is equal to the product of a mass and an acceleration, and an acceleration is the velocity generated per second.



PARALLELOGRAM OF FORCES.

Parallelogram of Velocities. If a body at B have a velocity represented by BA, it will travel over the distance BA in one second. Similarly, if it have a velocity represented by BD, it will travel to D in one second. If, however, the body tend to move with both these velocities at the same time, it will reach the point C at the end of a second, AC and DC being drawn parallel to BD and BA. Its path can also be shown to have been the diagonal BC; in fact, the body moves exactly as though it had the velocity represented by BC. This can be experimentally illustrated by

letting a marble move along a groove in the direction B A, while at the same time the board containing the groove is moved in the direction



PARALLELOGRAM OF
VELOCITIES.

B D. The groove will then lie along D C, so that the marble will be at C. The proposition of the parallelogram of velocities can hence be stated in these terms:— If a body tend to move with two uniform velocities, which

can be represented in magnitude and direction by the two sides of a parallelogram drawn through any point B, the resultant velocity will be represented by that diagonal of the parallelogram which passes through B.

Parallel Roads, a series of raised beaches one above the other, round the head and sides of Glen Roy in the west of Scotland and other similar situations. In Glen Roy they are 1,140, 1,059, and 847 feet respectively above sea-level. They were the subject of much controversy until it was suggested that the glen had been occupied by a lake supported at what is now the open mouth of the valley by glacier ice.

Paralysis. This is the term applied to the impairment or loss of the power of movement in muscles. Where there is only partial loss of power the condition is sometimes termed paresis. The inability to move a muscle may be due to disease affecting the muscle itself, or to interference with some portion of the nervous structures connecting the muscle with the central nervous system. The portions of the brain in which voluntary impulses causing the movement of muscles originate have been definitely mapped out. [BRAIN.] From the grey matter of the convolutions surrounding the fissure of Rolando, motor impulses descend, along what is known as the motor path, through the internal capsule of the corpus striatum, the crura cerebri, the pons Varolii, and the anterior pyramids of the medulla; at this point the fibres conveying the motor impulses cross over, certain of those which have been located on the right side of the brain being transferred and travelling downwards on the left side of the spinal cord and *vice versa*; this crossing over is known as the *decussation of the pyramids*. The motor fibres continue downwards mainly in the lateral columns of the cord, and ultimately break up into a network, which communicates with certain ganglion cells in the anterior horns of the grey matter of the cord. These ganglion cells are in communication by their processes with the fibres of the anterior or motor roots of the several spinal nerves, and down these nerves the motor impulses pass, until they finally reach the peripheral nerve terminations in the muscles. The motor impulse thus starts in a ganglion cell in the grey matter of one side of the cerebral cortex, pursues its path through the brain on that side, traverses the spinal cord, in the majority of cases, on the opposite side, and reaches a second ganglion cell in the grey matter of the cord; from this second ganglion cell the impulse is transmitted through the motor nerve to the muscle.

A lesion affecting any part of the motor path may produce muscular paralysis, and it may be observed that certain peculiarities in the distribution of the paralysis are manifested in correspondence with the portion of the motor path which is affected. In the pons and medulla and in the spinal cord, the motor paths of the two sides are near one another, and a lesion in these situations may produce paralysis affecting both sides of the body. In the cerebral hemispheres the motor paths are widely separated from one another, and it thus comes about that a lesion involving the motor path there, usually produces paralysis limited to one side of the body. If the motor path of the left cerebral hemisphere is involved, there will be paralysis of the right side of the body, this transference being, of course, due to the crossing over of the motor fibres already described as occurring at the decussation of the pyramids. Such a one-sided paralysis is called *hemiplegia*. In the spinal cord, on the other hand, a single lesion is likely to involve the motor paths conveying impulses to both sides of the body, and it must further be noted that only the muscles which are supplied by nerves leaving the cord below the seat of the mischief are involved. Thus, if the lesion be situated in the dorsal region of the spinal cord, the upper limbs will not be paralysed, only the lower extremities and parts of the trunk being affected. If the cervical portion of the cord above the origin of the nerves which go to form the brachial plexus be implicated, the muscles of the arms are involved, and if the disease extends as far upwards as the origins of the phrenic nerves, the diaphragm will be paralysed. Paralysis due to disease of the spinal cord, and affecting both sides of the body supplied by nerves taking origin from below the upper limit of disease in the cord, is termed *paraplegia*. In paraplegia the nerve centres in the lumbar portion of the cord are generally involved, leading to involuntary discharge of the contents of the rectum and bladder. When those portions of the central nervous system in which the motor tracts from both cerebral hemispheres lie in close proximity are involved by disease, *cross paralysis* is sometimes met with; for example, in disease of the pons Varolii, paralysis of one half of the body is sometimes accompanied by paralysis of the opposite side of the face.

In one form of disease of the brain causing paralysis, the muscles affected are not limited to one side of the body; this *general paralysis* is almost always associated with insanity (q.v.). The ordinary paralysis of cerebral origin is, as already remarked, hemiplegic in character, affecting the opposite side of the body to that in which the cerebral lesion is located. It may be noted, however, that it does not affect all muscles on the paralysed side equally. The muscles of the eye, those of mastication, and those of the upper part of the face, for example, usually escape; neither are the muscles supplied by the vagus nerve nor those of the neck and trunk implicated. The muscles of the limbs are always involved, the lower extremity sometimes to a less extent than the upper.

When paralysis is due to disease in the pons and medulla, the near neighbourhood of the nuclei of

origin of certain important nerves is likely to cause special symptoms to be present; moreover, cross paralysis is a common phenomenon, for the reason already noted. In the form of disease known as glosso-labio-laryngeal paralysis, the nuclei of certain nerves taking origin from the medulla are particularly affected, with consequent paralysis of the lips, tongue, and muscles of the larynx.

[For some account of the various forms of lesion which may affect the brain and spinal cord, producing hemiplegia or paraplegia, *see* BRAIN, SPINAL CORD.]

Paralysis is in some cases due to the involvement of motor nerves themselves by disease, as, for example, in facial palsy (Bell's palsy), due to disease affecting the facial nerve. [NEURITIS.] Again, paralysis may be due to disease affecting the muscular tissue, as, for example, in what is known as pseudo-hypertrophic paralysis. It remains to be noted that paralytic symptoms are frequently met with in hysteria.

Paralysis agitans is a form of paralysis which is accompanied by tremor and rigidity of muscles; the tremor is a more prominent symptom than the paralysis, the affected muscles manifesting involuntary rhythmical contractions, and the disease is thus sometimes known as shaking palsy. Persons advanced in life are usually affected, and the disease is of an eminently chronic character.

Paramœcium. [SLIPPER ANIMALCULE.]

Paraná. 1. A river of Brazil, rises in the state of Minas Geraes, and is called Rio Grande till its junction with the Paranahyba. It then flows in a south-westerly direction, skirting Paraguay, and finally joining the Paraguay river just above Corrientes. It afterwards unites with the Uruguay to form the Rio de la Plata, near Buenos Ayres, where it discharges itself into the sea after a course of some 2,000 miles. The Argentine towns of Santa Fé and Rosario stand on its banks. It is navigable to the point where the Paraguay meets it, and even at low water for 400 miles. Just above the mouth of the Ignassu begin the rapids, which extend for 100 miles up the river.

2. A southern state of Brazil, with an area of 85,000 square miles, the capital of which is Curitiba.

3. The former capital of the Argentine Confederation, in the province of Entre Rios, 400 miles from Buenos Ayres.

Paranahyba, the easternmost state of Brazil, has an area of upwards of 28,000 square miles. The capital, of the same name, situated 10 miles from the mouth of the Paranahyba, exports sugar and cotton-seed. Another river of the same name, an affluent of the Rio Grande, is in the southern states of Sao Paulo and Minas Geraes.

Paraplegia. [PARALYSIS.]

Parapodia, the lateral processes on the body of many worms of the class Chætopoda (q.v.); they usually support the bristles or setæ, and may serve for locomotion or respiration.

Parasites are organisms that live upon other organisms, whether plants or animals. Those that

merely live in company with others, and do not obtain their food from the organism with which they dwell, are known as commensals. Parasitism is very widely spread in the animal kingdom, and it has representatives in most groups, especially of the Invertebrata. Nearly all animals are subject to their attacks. Among the Protozoa, numerous Infusoria, such as *Trichomanes* and most of the Gregarines (q.v.), which live in the lungs of frogs and the digestive tube of worms, are parasitic. There are few representatives among the Cœlenterata or Echinoderms, but the worms include many of the most destructive. Thus all the Entozoa are parasitic, including the tapeworms, liver-flukes, and the tropical parasites *Bilharzia* and *Filaria*, which give rise to hæmaturia. Among other classes of worms, parasites occur in the Nematoda, such as those which cause grouse disease (*Strongylus pergracilis*) and the "gapes" of poultry (*Sclerostoma syngamus*); also in the Chætopoda, where the family *Myxostomidae* burrow in the stems of crinoids, and the genus *Oligognathus* lives in a Gephyrean. But few cases occur among the Mollusca, and the principal one is *Stylifer*, which is parasitic on starfish. The Arthropods supply many and interesting cases; thus in the Barnacles the males are parasitic on the females. There are many parasitic insects, such as the too well-known lice, fleas and bugs. Among the Arachnida the chief examples are the Ticks and Mites, the Pentastomida, which live in the nasal cavities of dogs, etc. Among the Crustacea there were two orders once recognised which included only parasites, these were the Ichthyophthira and Rhizocephala; but the orders are now abandoned, as it is known that the former included parasitic Copepods, and the latter parasitic Cirripedia. The history of these two orders illustrates the degeneration that always ensues when animals take to this mode of life. The only case of parasitism in Vertebrates is in the case of two genera of fishes forming the family Myxinoidei; the better known of these is Myxine, the Hagfish.

Parasitic Disease in Man. The parasites which are met with in the human subject may be divided into those belonging to the animal and those belonging to the vegetable kingdom. The former include certain members of the *tapeworm* family [TAPEWORMS, HYDATID], a number of *nematode* worms (the common round worm, the threadworm, trichina spiralis), and others. There are, moreover, a number of skin parasites, the itch insect and three varieties of pediculus being included among these. The organism of malaria has recently been declared to belong to the class of protozoa, and it is not unlikely that other members of this class are concerned in the production of disease in man.

The vegetable parasites consist of the fungi which are associated with some forms of skin disease (ringworm, favus, pityriasis, etc.). There is also the ray fungus which is the cause of the disease known as *actinomyces*, and the fungus of Madura foot. All these parasites are members of the various groups of fungi; but by far the most

important vegetable parasites are those which belong to the lowest group, the fission fungi. [BACTERIA.]

Parasitism, VEGETABLE, the growth of a plant attached to another living organism, and depending upon it wholly or in part for its nutriment. In other words, parasitism is that form of symbiosis (q.v.) in which the physiological benefit is entirely obtained by one of the associated organisms, the *parasite*, the other being termed the *host*. Every gradation from partial to complete parasitism exists, and some plants combine the character of *saprophytes* (q.v.), living, that is, upon dead organic matter, with parasitism. Parasitism is generally accompanied by the partial or complete loss of chlorophyll, and a reduction in leaves or other assimilating organs, they being rendered unnecessary by this habit. At the same time the uncertainty of the seedling finding a suitable host leads often to increase in the number of seeds. All true parasitic plants seem to be either fungi (q.v.) or dicotyledons, the latter belonging either to the Gamopetalæ (q.v.) or to the Incompletæ (q.v.). Only in the case of fungi do vegetable parasites attack animals. Such are the salmon-disease (*Saprolegnia ferax*), *Empusa*, and *Cordyceps*, which attack insects, and the fungi producing favus, ringworm and thrush in human beings. All fungi are either saprophytes or parasites, and in none is any chlorophyll present. Most of the parasitic forms are *entophytic*, growing, that is, mainly within the tissues of the host, producing copious mycelium (q.v.), and sending out *haustoria*, or sucker-like branches, through the cell-walls. *Pythium*, *Cystopus*, and the potato-disease (*Phytophthora*) are comparatively simple moulds. The "rust" of wheat (*Puccinia graminis*) is a typical example of heterœcism, which only occurs in fungal parasites; whilst *Agaricus melleus*, by means of its subterranean "rhizomorphs," and the various species of *Polyporus*, are examples of parasitic Hymenomycetes (q.v.). Flowering parasites mostly germinate in the ground, many of them retaining some roots of their own, though becoming attached to the underground portion of the host. The eye-bright, cow-wheat, yellow and red rattle, among Scrophulariaceæ (q.v.) are only partly parasitic and have small green leaves. The broom-rapes (q.v.), though with some roots, have no chlorophyll, and are doubtless more completely so. The dodder (q.v.) after attaching itself to the stem of the host, round which it twines, by haustoria, which are probably modified adventitious roots, dies at its own root, thus losing any connection with the ground. The mistletoe (q.v.), though germinating on the branch of the host tree, has chlorophyll, and is, therefore, not entirely dependent. The allied sandal-wood (q.v.), though a root parasite, resembles the mistletoe in this respect. No flowering-plant is more completely parasitic than *Rafflesia* (q.v.), which consists mainly of one huge flower on a short root penetrating the stem of its host.

Parchment, the name given to prepared skins of animals, which are used for writing on, and in the manufacture of various musical instruments.

The skins are first soaked in lime to remove the hair, then shaved, washed, dried and stretched, and finally smoothed with fine chalk or lime and pumice stone. The skins most used are those of the sheep and goat, but the skins of the wolf and ass are also used; whilst vellum—a fine kind of parchment—is made from the skins of calves, kids, and still-born lambs, and the skin of the fur-seal is sometimes used for very fine varieties. The Eskimos also use the entrails of seals. The word is also frequently used for a document written on parchment.

Pardon, the releasing of a person from the punishment he has incurred for some offence. In this country, as in most others, the prerogative of pardoning is vested in the sovereign. A pardon may be granted either before or during a prosecution, when it may be pleaded in bar, or after conviction, in which case it may be pleaded in arrest of judgment or in bar of execution, so that the offender is discharged from punishment. Some offences, however, cannot be pardoned; for instance, a common nuisance while it remains unredressed; and a pardon cannot be pleaded to a parliamentary impeachment. A pardon is granted by warrant under the Great Seal or under the sign manual. It may be free or conditional—that is, the Crown may annex to it a condition on the performance of which the pardon will depend. The effect of the pardon is to make the offender a new man, to acquit him of all corporal penalties and forfeitures annexed to the offence pardoned, and not so much to restore his former as to give him new credit and capacity.

Paré, AMBROSE (1509–90), the great French surgeon, was born at Laval. He rose from the humblest position to be surgeon-in-ordinary to four successive kings, and possessed in particular the confidence of Charles IX., by whom he was saved from sharing the fate of his coreligionists on the day of St. Bartholomew, 1572. To Paré's influence is ascribed even the cessation of the massacres.

Paregoric is the name given to a preparation in the British Pharmacopœia, the *tinctura camphoræ composita*. This tincture contains a small amount of opium, and benzoic acid, oil of anise, camphor and spirit. It is often used to relieve cough.

Parenchyma, cellular tissue in plants in which the individual cells are not elongated to more than four times their breadth. It may be loose or spongy, with spherical cells and large intercellular spaces, as in the mesophyll of many leaves; compact and *dodecahedral*, as in some pith; *muriform*, or brick-shaped, as in periderm; or *stellate*, as in the "pith" (mesophyll) of the rush.

Parent and Child. The duties of parents towards their children are mainly three; viz. (1) their maintenance, (2) their protection, and (3) their education. All these rest, more or less, on natural law.

1. *Their Maintenance*. The common law, which has proved in some respects deficient herein, has been supplemented by several statutes, the joint effect of which may be summarised as follows.

The father and mother, grandfather and grandmother, of any poor person not able to work shall maintain him or her at their own charges if of sufficient ability, according as the quarter sessions, or two justices in petty sessions, shall direct; and if a father runs away and leaves his children chargeable to a parish, the churchwardens and overseers shall, upon obtaining an order of magistrates for the purpose, seize his rents, goods and chattels, and dispose of them towards the required relief. Moreover, the parent himself in such a case may be punished under the Vagrant Acts; as he may also be, if, being able, he shall wilfully *refuse* or *neglect* to maintain his family, whereby they become chargeable. Also all the relief given under the poor laws to any children under the age of sixteen (such children not being blind or deaf and dumb) shall be considered as given to the father or (if he be dead) to his widow; and every person is made liable to maintain the children of his wife born before his marriage to her (whether legitimate or illegitimate) as part of his own family and is chargeable with all relief granted to them under the poor laws until they attain the age of sixteen or until the death of the mother.

Again, by other statutes, in any case in which any child is detained in a certified "reformatory" or "industrial" school, the parent, step-parent, or other person liable for his maintenance, if of sufficient ability, is made liable to contribute to his support, maintenance, and training therein to the extent of 5s. per week or such lesser sum as shall be directed. No person, however, is bound to provide a maintenance for his issue, unless where the children are impotent and unable to work either through infancy, disease or accident, and then is only obliged to find them in necessities.

2. *Their Protection.* This duty is distinctly recognised in English jurisprudence, it being laid down in particular that a parent may maintain and uphold his children in their law-suits without being guilty of the offence of maintaining quarrels, and that he may also justify an assault and battery in defence of their persons.

3. *Their Education.* The third duty of parents is to give their children education suitable to their station in life, a duty which is also pointed out by reason. In our own country ample provision for the education of children has from the earliest times been made by our churches and chapels and by the multitude of wealthy persons and corporations; but by reason of the vast increase of the population the supply (at least of elementary schools) has never outstepped the demand, and this matter received the special attention of the Legislature in the year 1870 by the passing of the "Public Elementary Education Act," by which Act very extensive further provision was made for the education of the poorer classes of children, and the duty of seeing to their education was made compulsory on the parent, and in 1891, when education was practically made free.

Parhelion is an image of the sun often formed when halos intersect, parhelia are hence often called mock-suns. Solar halos are generally considered

to be due to refraction and reflection of the sun's rays by ice crystals in the higher strata of the air. Double refraction by the crystals may cause two halos, and reflection from the ice faces may give rise to others, some of these will probably intersect causing a parhelion to be seen. The parhelia are usually brightly coloured like the halo, and are sometimes accompanied by fiery tails. Some very fine parhelia were seen at Brighton on June 5, 1875.

Pariah, a term wrongly applied by Europeans to all outcastes in India, but properly restricted to a distinct group of thirteen low castes included in the "Right" division in the south. The true outcastes are the Chandalas of the sacred writings, the Kanjars of the Central Provinces, the Palayars of Travancore. *Pariah* (properly *Pahariah*) simply means "highlander," and was originally applied by the Aryan intruders to the dark aborigines driven by them to the hills, and excluded from their social organisation. Hence its secondary meaning, which has been extended even to those dogs which in the East have reverted to a semi-wild state, prowling in packs about the outskirts of the towns and doing scavenger work like some of the Indian pariahs.

Paris. [DOMITIAN.]

Paris, the capital of France, and one of the most ancient cities in Europe, was first known by its Latin name of Lutetia. It was the favourite residence of more than one Roman Emperor; and the remains of the *Thermæ*, or warm baths, of Roman construction are still to be found in the Palais des Thermes. The name Lutetia is generally derived from *lutus* or *lutum*, signifying "mud;" and though one hesitates to accept this ignoble origin for the name of a city which nineteen centuries ago was already known as a town of brightness and joy, it is nevertheless a fact that the original Lutetia was concentrated in an island which was not only surrounded by water, but was still further protected on more than one side by impassable marshes.

During a long course of years Paris was looked upon as a nautical city. In its arms a ship figured as the principal emblem, and does so even to this day. The commercial destinies of the city were controlled by a council of shipowners or *nautæ*, as in Roman times they were called; and the "mud city of the Parisians" had several times to defend itself, for the most part without success, against the attacks of Norman pirates, advancing from the neighbourhood of Rouen and from the regions between Rouen and the mouth of the Seine. By these invaders Paris was plundered and burned. Then it was built up again on a larger scale; but only to be pillaged and destroyed again and again. At last the warlike Normans directed their energies towards a more important point; and Paris, which was never razed to the ground but to spring up again in greater beauty and greater strength, was allowed to pursue unimpeded its natural growth.

The topographical—one may also say the geometrical—history of Paris is from this moment the

history of its extension towards the walls built to enclose it. Its fortifications, its barriers, have had to be pulled down and built up again some distance farther out; and this process has been several times repeated. The boulevards of the present day, which seem to be, and in fact are, in the very heart of the city, were at one time ramparts. Many of what used to be known as the "outside boulevards" are now well within the walls; and the fortifications erected in the reign of Louis Philippe (who reigned from 1830 to 1848) were, after the Franco-German War (1870-1871), found useless and in the way; not only because they had failed to prevent the investment and bombardment of the city, but also, and above all, because the city had outgrown them. Once more it has burst its boundaries; and to enable it to breathe with freedom, it has been found necessary to pull down a portion, at least, of the defences that bound it so tightly without defending it entirely against a besieging enemy. A wide girdle of outlying, interconnected forts has recently been constructed around Paris far in advance of the old fortifications.

The sieges undergone by Paris can scarcely be counted. Even in modern times, and during the last eighty years, it has three times been entered by force: by the Powers allied against the first Napoleon in 1814 and 1815, and by the united Germans in 1871. In the civil and religious wars, by which France so long was devastated, Paris was frequently the scene of conflicts, sometimes in the streets and public places, more often outside the walls. Joan of Arc (more properly "Jeanne Darc") was once with an army besieging, or at least attacking, Paris from the heights of Montmartre. It was outside Paris, at the head of a victorious army, that Henry IV. uttered his celebrated exclamation as to Paris being "well worth a mass" (*Paris vaut bien une messe*); whereupon he made peace with his already vanquished enemies, and entered the capital to hear mass at Notre Dame.

The French revolutions of the last hundred years have all been originated and accomplished inside Paris, without reference to the views of the provinces, where the decisions of the capital have always been accepted. In 1789 the taking of the Bastille was the first incident in a struggle which ended in the destruction of the ancient monarchy, the decapitation of the king by the newly-invented guillotine, and the establishment of the Republic. After the excesses of the Revolution (which, meanwhile, had introduced many invaluable reforms), it was at Paris that Napoleon made his *coup d'état* with the view, soon to be realised, of concentrating all power within his own hands. When the Parisians had tolerated the government of the Restoration for sixteen years, it was at Paris that the revolution broke out which drove Charles X. from his throne, similarly expelled in 1818.

Of the many great public buildings only a very few can here be mentioned. The cathedral of Notre Dame dates in part from the 14th century. The Panthéon, built as the church of Ste. Geneviève in 1764, has alternated between its original function and that of a (non-Christian) mausoleum for great

men. The Madeleine, built by Napoleon I. as a temple of Victory, is an admirable specimen of modern classical architecture; the Sainte Chapelle (in the Palais de Justice); and the great new church of the Sacred Heart on Montmartre. Of the numerous palaces, the Tuileries, begun by Catherine de Medicis, the royal and imperial residence, was chiefly burnt by the Commune; the Louvre (begun 1541) has since 1793 been the home of the great collections of art and antiquities (*see below*); the Elysée is devoted to the President, the Luxembourg to the Senate; the Palais Royal, the residence of Philippe Egalité (q.v.), has long been the first of bazaars. The Grand Opera is a costly and gorgeous monument of the Second Empire; the Sorbonne, in the Quartier Latin, is the seat of the University. The Bibliothèque Nationale, the collections of art and antiquities in the Louvre and those in the Hôtel Cluny, the collection of modern French pictures at the Luxembourg, the zoological and botanical gardens of the Jardin des Plantes, can hardly be rivalled save in London. The Palais de Justice and Hôtel de Ville are among the finest recent buildings, and three great monuments of Napoléon I. remain—the Hôtel des Invalides, the Arc de Triomphe, and the Vendôme Column. The parks and gardens of Paris have long been famous as triumphs of art, especially the Tuileries gardens, the Buttes-Chaumont, the Parc Monceau, and the more spacious and less artificial Bois de Vincennes and Bois de Boulogne. The exhibitions of Paris have left traces in the Palais de l'Industrie (1855), the Trocadéro Palace (1878), and the Eiffel Tower (1889). The water supply and sanitation have been greatly improved of late years.

Paris, since the Third Republic—which has now lasted longer than any government established in France for more than a century—has lost some of its attractions. The nobility, in the absence of a Court, cares but little for life in Paris, and remains in the country. One effect of this abstinence on the part of the French aristocracy may be seen in the impossibility of maintaining an Italian Opera, as it existed under the First Empire, the Restoration, the reign of Louis Philippe, and the Second Empire. The flight of Louis Philippe and of his minister Guizot (who escaped in the disguise of a footman) was followed by the establishment of a republic over which Lamartine, General Cavaignac and Prince Louis Napoleon successively presided. On the 2nd of December 1851, the Prince President executed a *coup d'état*. He dissolved the Chamber, arrested, imprisoned, and afterwards exiled many of its principal members, occupied the streets of Paris with troops, suppressed all resistance, introduced universal suffrage, and got himself elected President for ten years. A year later he transformed the republic into an empire, and proclaimed himself emperor. Two years later came the Crimean War, and on its conclusion in 1856 the emperor began to occupy himself seriously with a system of public works which he had thought of from the beginning, and which, from 1856 until the abrupt termination of his reign, was pursued with unceasing activity. Up to 1859 (when

the liberation of Lombardy from Austrian rule gave to the Second Empire a new glory) the sum spent annually on public works averaged about £600,000, from 1859 until the fall of the Empire at least £700,000.

It has been computed that of all the Paris houses existing in 1870, less than one-third had been built prior to 1852. This seems at first an



FAÇADE OF THE MADELEINE, PARIS.

exaggerated estimate; but the "continuation of the Rue de Rivoli"—one of the principal domestic performances of the Second Empire—involved the destruction of entire streets, in which, here and there, some historic building alone was spared.

Some cynical or merely thoughtless critics of the Second Empire could see nothing in the widening and prolongation of the principal streets of Paris, but a preparation for sweeping them with artillery, when the day should come for him either to disappear as Louis Philippe and Charles X. (not to mention the unhappy Louis XVI.), had disappeared before him, or to defend his position and remain. His chief if not his sole object was to make of Paris the finest and most salubrious city in the world; though the abundant occupation ensured to workmen of various kinds had doubtless the effect of keeping at peace the most dangerous part of the Paris population.

From 1860 to 1870 the prosperity of the French capital seemed at its height. Perhaps the most brilliant year of the whole period of the Second Empire was 1867, when King William of Prussia (afterwards to be known as the "Emperor William"), Bismarck, and Moltke all visited the Universal Exhibition of Paris, there to meet royalties, and excellencies of all nations, with Prince Gortschakoff, Russian Minister of Foreign Affairs, prominent among them.

The war of 1870, and especially the Battle of Sedan, brought the Second Empire to an end without a blow being struck by its enemies in the

French capital. The siege did little harm to the city; but on the overthrow of the Commune, the Hôtel de Ville, the Palais de Justice, the Tuileries, and the Ministry of Finance, were deliberately fired by the insurgents, as well as many other buildings.

Since the establishment of the Third Republic France, while keeping herself prepared for war, has remained at peace.

Paris, or ALEXANDER, one of the chief personages in the Homeric story, was the second son of Priam, King of Troy and Hecuba, who dreamed that she had brought forth a firebrand. Euripides makes his father give him to a shepherd to be exposed on Mount Ida, where, however, he was fed by a she-bear and brought up by the shepherd, till at length he is discovered and owned by Priam. His wife Ænone warns him not to go to Greece, but he does so, and carries off Helen from her husband Menelaus, King of Sparta. This gave rise to the siege of Troy by the Greeks, led by Agamemnon, brother of Menelaus. Hera and Athene took the side of the Greeks, because Paris had given the golden apple, the prize of beauty, to Aphrodite. She it was who saved him when worsted in the combat by Menelaus. During the siege Paris kills Achilles by a stratagem, but is wounded when the city was taken by a poisoned arrow shot by Philoctetes. Of this wound he dies, the injured Ænone refusing to heal it.

Paris, FRANÇOIS DE, a Jansenist deacon, who died in 1727. He was buried at St. Médard, and crowds made pilgrimages to his grave, where, it was alleged, miracles were wrought. From the ecstatic attitudes here assumed by the Jansenists, they acquired the name of Convulsionnaires.

Paris, LOUIS PHILIPPE, COMTE DE, grandson of King Louis Philippe and son of the Duc d'Orléans, was born in 1838. He lived chiefly in England until 1871, and then returned to his French estates, which had been restored to him. In 1873, at Frohsdorf, he agreed that his claims to the French crown should give way to those of the Comte de Chambord; and when in 1883 the representative of the elder line of the Bourbons died, all the Legitimists acknowledged him as head of the House. Three years later he retired again to England, in consequence of a decree of expulsion passed by the French Chambers. In 1888 he issued a manifesto in favour of revision. He is author of several economical works.

Paris, MATTHEW, the best of the English chroniclers, was born about the beginning of the 13th century. When still young he entered the Benedictine abbey of St Albans, and in 1248 was sent by the Pope to Norway as visitor of the order. He died in 1259. Judging from internal evidence, he seems to have been an Englishman, but we know nothing of his parentage. He seems to have been an accomplished mathematician and poet, as well as a historian, and was intimate with King Henry III. His *Chronica Majora* is a continuation of Roger of Wendover's work from the year 1235, and is a very valuable authority on the times of

Henry III. He also wrote *Lives of the Abbots of St. Albans*; and the *Flores Historiarum*, usually attributed to Matthew of Westminster, may also have been his work. The *Chronica Majora* was edited by Dr. Luard for the Rolls Series in 1872-73.

Parish, an ecclesiastical and now, in the British Empire, a civil district, generally comprising the locality originally placed under the charge of one priest or minister, and now separately rated to the relief of the poor. Originally the parish (Late Latin, *parochia*, *parœcia*; ecclesiastical Greek, *paroikia*, "neighbourhood") was the district or diocese under the charge of a bishop. In Great Britain up to 1894 about two-thirds of the civil parishes, which are divisions of a town or county for purposes of local government, were coterminous with the ecclesiastical parishes, and the controlling local authority in England and Wales was the vestry under the presidency of the incumbent, the officers being churchwardens, overseers, guardians, and constables; but from 1894 the elective parish council is to have the control of all the temporal business of local government so far as it is delegated to the parish, and the limits of civil parishes are considerably altered in many cases. Independent subdivisions of towns and counties for special purposes have also been called parishes. In Louisiana, United States, the counties are called parishes.

Park, MUNGO (1771-1806), the African traveller, was the seventh son of a Selkirkshire farmer. He was educated at Edinburgh University, and became a naval surgeon. In 1792 he went to Sumatra on board the *Worcester*, and wrote an account of eight new species of fish he discovered there, for the Linnæan Society. Three years later, by the influence of Sir Joseph Banks, he was employed by the African Association, and in the course of the year 1796 penetrated to the sources of the Niger. In 1799 he published his *Travels in the Interior of Africa*, and until the end of 1804 lived the quiet life of a country doctor at Peebles. Early in 1805 he took command of Lord Hobart's Niger expedition. When the party reached Bammako it had been reduced by disease from forty-four to eleven; and the rest, persevering in their course, seem to have perished at Boussa, where they were attacked by the natives and drowned in trying to escape. An account of the second journey appeared in 1815.

Parker, MATTHEW (1504-75), Archbishop of Canterbury, was born at Norwich. At Cambridge he was famous both for his scholarship and his preaching. In 1544 he became Master of Corpus Christi College and, after having been chaplain to Anne Boleyn and Henry VIII., was made Dean of Ely by Edward VI. At the accession of Mary, when he had for some years been a Protestant, he was deprived of his offices; but when Elizabeth came to the throne she made him Primate, in spite of his being a married man. With her he elaborated the compromise with the extreme Protestants which was formulated in the Thirty-Nine Articles of 1562. To him was due also the Bishop's Bible.

Parker, THEODORE (1810-60), was the son of a small farmer at Lexington, Massachusetts. While remaining a farmer he studied at Harvard. In 1837, after having for some years kept a school, he became a Unitarian minister, but in consequence of a sermon preached in 1841 lost many of his supporters, and had to retire to Europe. In 1846 he seceded, and joined a freer society. His later years were occupied in preaching and writing, the abolition of slavery finding in him a powerful advocate. He died at Florence just before the outbreak of the war he had foreseen.

Parkeria, a genus of spherical fossils from the Greensand of Cambridge, which has been regarded as a gigantic arenaceous Foraminifer (q.v.), but is now assigned to the Hydrozoa.

Parkes, SIR HENRY, was born in 1815, the son of a Warwickshire farmer. In 1839 he emigrated to New South Wales. For several years he conducted a newspaper at Sydney, to whose Legislative Council he was elected in 1854. In 1866 he became Colonial Secretary, was Education Minister in 1867-70, and was Premier of New South Wales from 1872-75, in 1877, from 1878-83, and 1887-91.

Parkes' Process is a process employed for extracting the silver from argentiferous lead. As most lead ores contain some silver, the lead smelted from the ores is always more or less rich in the more valuable metal. In Parkes' process a small quantity of melted zinc is added to the molten lead and well stirred. When the mass cools the zinc rises to the surface and is skimmed off, it being found that the greater part of the silver has passed into the zinc from which it is subsequently extracted.

Parkman, FRANCIS (1823-93), one of the best American historians, was born in Boston, Massachusetts, and educated at Harvard. He obtained an intimate knowledge of Indian life by living among the Indians in Canada and Dakota, and in 1851 published *The Conspiracy of Pontiac*. This was followed by other valuable works, such as *The Pioneers of France in the New World*, *La Salle and the Discovery of the Great West* (1869), *The Old Régime in Canada*, and *Montcalm and Wolfe* (1884), French and German editions of most of which have appeared.

Parlement, one of the local courts of justice in France prior to the Revolution of 1789, of which the chief was the Parliament (French, *Parlement*) of Paris. This originated in the royal council, and early in the fourteenth century was organised into three chambers, the *Grande Chambre*, the *Chambre des Requêtes*, and the *Chambre des Enquêtes*. It acquired considerable political influence in the seventeenth and eighteenth centuries.

Parliament, the supreme national council and legislature of England, which developed from the king's council of barons and tenants in chief of the Crown and the great officers of court. The first move in a popular direction was opposition to the sovereign on the part of his councillors; next came the establishment by Magna Charta (1215) of a

fixed supreme civil court; thirdly, the admission of knights of the shires towards the end of John's reign; next, the election of twelve representatives by the commonalty (1258), when a permanent council of fifteen—the forerunner of the Privy Council and the Cabinet, was instituted—and, lastly, the summoning of elected knights and burgesses to the parliaments or councils of 1265 and 1295. The division of Parliament into two houses was completed by 1341, and during the reign of Edward III. its powers developed substantially. After a fluctuating but gradually progressive career, the authority of Parliament was finally confirmed on the accession of William III. Its constitution has been modified by the Triennial Act (1694), when party government began, the Septennial Act (1716), and the reforms of the House of Commons dated 1832, 1867, 1884, and 1885. The Imperial Parliament now consists of the Sovereign, the House of Lords (containing about 600 peers), and the House of Commons (containing 670 members, each member representing one electoral division). In addition to their legislative functions, either house, “in High Court of Parliament assembled,” sits as a judicial court to try certain special cases, such as high treason, contempt of Parliament, and misconduct of public officers. There was a Scots Parliament until the Union (1707), and an Irish Parliament from 1782 to 1799. The self-governing colonies of the British Empire have Parliaments, and the term is applied to foreign legislative bodies. [DIET, RIGSDAG, REICHSTAG, SKUPSHTINA, STORTHING.]

Parliamentary Bill. Before a bill becomes an Act of Parliament (q.v.) it must be approved by the Lords and Commons, and receive the royal assent. In either House a public bill must be read twice, go into committee, and be then reported to the House and read a third time, before being sent to the other House.

Parliaments, CLERK OF, is one of the chief officers of the House of Lords. He is appointed by the Crown by letters patent. On entering office, he makes a declaration to make true entries and records of the things done and passed in the Parliaments, and to keep secret all such matters as shall be treated therein. By a statute of George III.'s reign he is directed to endorse on every Act the date on which it receives the royal assent.

Parma, the capital of a small province of northern Italy, is situated on a river of the same name nearly midway between Bologna and Milan, on the old Via Æmilia. It was formerly the chief town of a duchy which lay between the Milanese and Modena. Parma and Piacenza, with the surrounding territory, passed from the Pope to the Farnese family, and from them to the Spanish Bourbons, who (with a short interval) held it (with Guastalla) till, in 1796, it was occupied by the French. From 1814 till 1847 the duchy belonged to Maria Louisa, wife of Napoleon. In the interval before its incorporation, in 1860, with the kingdom of Italy it was ruled by the Duke of Lucca. The city of Parma is noted for its art treasures. The

ducal palace has a fine gallery of Corregios, and there are frescoes by this artist in the 11th-century cathedral and the church of St. John. The church of Madonna della Steccata contains the tombs of the Farnese. Parma has a university, and is notable for its Baptistry and the ducal library. The place was twice besieged by the Emperor Frederick II. Pianofortes are made here, and there is a flourishing trade in cattle, corn, and silk.

Parmenides, one of the chief of the Eleatic school of philosophers, flourished about 450 B.C. His philosophy, conveyed in a poetic form, was designed to demonstrate the reality of Absolute Being, and he approaches some modern identifications of it with thought. The remains of his works were translated into English hexameters by Thomas Davidson (1870), a prose version being given in W. L. Courtney's *Studies in Philosophy* (1882).

Parmigiano, GIROLAMO FRANCESCO MAZZOLA, one of the best painters of the Lombard school, was born at Parma in 1504. He began to paint at an early age, and 1523 went to Rome. Here Clement VII. became his patron, and he was at work upon his *Vision of St. Jerome* (now in the National Gallery) when four years later the Imperialist troops captured the city. After spending about four years at Bologna, he returned to his birthplace, but died in 1540 near Cremona, after having been imprisoned for his dilatoriness in executing the frescoes for Santa Maria Steccata, in Parma. A *Madonna and Child* by him is at Bologna, and he painted portraits of Amerigo Vespucci and other contemporaries. His *Cupid Shaping a Bow*, a well-known picture, is at Vienna.

Parnassus, Grass of, a beautiful British plant (*Parnassia palustris*), of somewhat doubtful affinities among Dicotyledons. It is common in bogs in mountainous regions, bearing heart-shaped radical leaves, and a solitary creamy-white pentamerous flower, more than an inch across, with delicately veined petals, and five ciliate scale-like nectaries, one at the base of each petal. The five spreading stamens, which are alternate with the petals, rise in succession and burst outwards.

Parnell, CHARLES STEWART (1846–91), was born at Avondale, in Wicklow, and educated at Cambridge. In 1875 he was an unsuccessful candidate for the county of Dublin, but was soon after returned as a Home Ruler for Meath. During this, his first parliament, he and Mr. Biggar elaborated the policy of obstruction. When Isaac Butt died, in 1879, Parnell became the virtual leader of the Home Rulers, though Mr. Shaw nominally succeeded him. Parnell was elected for three constituencies in 1880, and now left Meath for the city of Cork. He threw himself into the land agitation, and visited the United States to raise funds. As President of the Land League he was prosecuted at the end of the year, but the jury could not agree upon a verdict. The pitch to which he carried his opposition to the Coercion Bill of 1881 necessitated his removal, with more than thirty of his followers, from the House of Commons on February 3rd.

Next year he was sent to Kilmainham for issuing the "No Rent" manifesto, but was released, after eight months' confinement, in May, 1882. He condemned the Phoenix Park murders, opposed the Crimes Bill, and in 1884 the Land League was revived under another name, with Parnell as its president. His popularity among Irishmen was attested by a testimonial presented to him in 1883, and his power in Ireland was shown by the fact that in the elections of 1885 the Home Rule candidates were practically his nominees. The number of his following now enabled him to hold the balance between parties in the Imperial Parliament; and, being unable to obtain anything from the Conservatives, he assisted Mr. Gladstone to overthrow their Ministry. When the Liberal leader brought in a Home Rule Bill he supported him, and opposed the Coalition Ministry which followed the rejection of it by the country. In 1889 Parnell reached the height of his popularity, after the exposure of the Pigott forgery. A year later, however, the result of the O'Shea divorce case closed his career.

Parnell, THOMAS (1679-1717), the poet, was born in Ireland and educated at Trinity College, Dublin. In 1705 he was appointed Archdeacon of Clogher, but he was much in London, where he enjoyed the best literary society of the day. He died at Chester. He was author of *The Hermit* and some odes, and had a ready wit.

Parnell Commission. Just before the third reading of the "Coercion Bill" in 1887 the *Times* (April 18th) published a facsimile of an alleged letter from Mr. Parnell, dated 1882, approving the Phoenix Park murders. In 1888, on the production of other letters, a commission of three judges was appointed to investigate the whole question of the alleged connection between the Irish Parliamentary party and Irish crime. The letters were admitted (February, 1889) to be forged by one Pigott, who committed suicide (March). Mr. Parnell's action for libel against the *Times* was consequently settled by the payment to him of £5,000 and costs. The Report (February 13th, 1890) exonerated the Irish members from the graver charges, though not from incitement to intimidation or from association with the Irish revolutionists in America.

Parody, a literary travesty of a serious composition in which the style and verbiage of the original are imitated for the expression of quite different and generally ridiculous ideas, or in which mannerisms are absurdly exaggerated. An instance of a parody which is as serious, but for the obviousness of the imitation, as the original is Mr. Carroll's, "Take care of the sense, and the sounds will take care of themselves."

Paros, a member of the Cyclades group in the Grecian Archipelago, celebrated for its white marble quarries. Archilochus and Polygnotus were natives of this island.

Parotid Gland. [SALIVARY GLANDS, MUMPS.]

Parquetry, ornamental work composed of pieces of variously-coloured wood fitted closely

together so as to form simple patterns. The lines of junction are generally straight. It is employed chiefly for floors, wainscots, and panels.

Parr. [SALMON.]

Parr, KATHARINE, Queen-Consort of Henry VIII., was born in 1512, the daughter of Sir Thomas Parr, of Kendal. She was married when quite a girl to a certain Edward Borough, after whose death she became the wife of John, Lord Latimer. After his death she had made up her mind to take as her third husband Sir Thomas Seymour (brother of Queen Jane), but was constrained, much against her will, to marry Henry VIII. in 1543. She interceded successfully with him on behalf of his daughters, and favoured (in a discreet manner) the reformed opinions. She was an accomplished classical scholar, and wrote a work called *The Lamentation or Complaint of a Sinner*. Not long after the king's death, she married her old suitor, Seymour, but died in 1548, at the age of thirty-six.

Parr, SAMUEL (1747-1825), the well-known scholar and conversationalist, was born at Harrow, and educated there and at Cambridge. After being some years an assistant-master at Harrow, he kept a school at Stanmore, and was afterwards headmaster at Colchester and Norwich grammar-schools. The latter part of his life was spent at his vicarage of Hatton, Warwick, where he died. He was a good Latin scholar, and a better Whig and talker.

Parrakeet, a popular name for any small parrot with a long tail. Among the best-known are the Zebra Parrakeet (*Melopsittacus undulatus*), the Crested Parrakeet (*Nymphicus nova-hollandiae*), the Rose-ringed Parrakeet (*Ptilinopus torquatus*), and the Alexandrine Parrakeet (*Ptilinopus alexandri*), said to have been brought to Europe by Alexander the Great.

Parrot, a name applicable to any bird of the group Psittaci, to which some systematists give ordinal rank, while others regard it as no more than a family. These birds are widely distributed, chiefly in tropical and sub-tropical regions, and have the bill large and powerful, much arched, and elongated at the tip, with the nostrils in the cere. The wings and tail are usually long; there are two toes in front and two behind. This group includes many widely-divergent forms—the Cockatoos, Macaws, Lories, Parrakeets, and the aberrant species from New Zealand, one of which, the Owl Parrot (*Stringops habroptilus*), is flightless, and another, the Kaka (q.v.), has developed carnivorous habits. The plumage in the group is generally brilliant, green and red predominating; but some are soberly clad. The African parrot (*Psittacus erythacus*), probably the commonest cage-bird of the group, and certainly the one longest known, is bluish-grey, with the exception of the red tail feathers, while the black of *Micropodops aterrimus* is only lightened by some crimson on the cheeks. Parrots are remarkable for their power of imitating sounds, including human speech, but the Indian Myna (q.v.) is said to rival them in this accomplishment.

Parrot Fish, PARROT WRASSE, any fish of the Labroid genus *Scarus* and some allied genera, so called from their brilliant coloration, and the beak-like shape of the jaws. *Scarus* has nine species from the tropical Atlantic, and one (*S. cretensis*) from the Mediterranean. This last was known to the Romans, and by them highly esteemed as a delicacy. The other genera, with about eighty species, are tropical, and, though most of them are eaten, some acquire poisonous properties from their food, which consists of corals or fucus.

Parsees (*i.e.* "Persians"), direct descendants of the old Persian Zoroastrians, who rejected Islâm when the Arabs overran Persia in the seventh century. Some remained in the country, where they are called *Ghebres* (Ghebar), and where they numbered 8,200 in 1879, centred chiefly in Yezd and Kirman. The rest were expelled about 800 A.D., and after a short stay, first in Ormuz Island, at the entrance of the Persian Gulf, and then in Deb (Diu) Island, on the Kattiwar coast, finally settled on the Indian mainland, where their chief seats are Surat and Bombay, and where in 1881 they numbered 85,000, of whom 75,000 are in the Bombay Presidency, and 10,000 in the rest of India; they form a wealthy community, characterised by great solidarity and munificence, and are engaged chiefly in trade. Although now speaking Gujarati and English exclusively, their Persian origin is shown by their religion, unbroken traditions, and type; they are not "fire-worshippers," as is popularly supposed, but venerate fire and the sun as the purest emblems of the deity. Of the old Zoroastrian religion little is preserved except the symbols and formulas, the dualistic principle tending to merge in a vague deism, with truth and universal benevolence as the cardinal virtues. They live up to a high moral standard, are strict monogamists, and treat their women with great respect. The dead are exposed in the Lakhma ("Towers of Silence"), where they are left to be consumed by the elements or by carrion birds.

Parsifal, the hero of the Teutonic legend concerning the Holy Grail (q.v.). He is the Galahad of the Arthurian legends. Wagner's poem was based on the story as given by Wolfram von Eschenbach.

Parsley (*Carum Petroselinum*), an Umbelliferous plant, widely cultivated, but of uncertain origin, though probably native in eastern Europe. In cultivation it is remarkable for its bright-green, pinnately-divided and crisped leaves, which, besides being used as a flavourer in melted butter and soups, are largely employed as a merely ornamental garnish to cold meat, butter, etc. A good deal of superstitious reverence attaches to this plant, which is believed to have been dedicated first to Selene, goddess of the dead, and afterwards to St. Peter as door-keeper of Paradise. The fruit, the characteristic feature of Umbelliferae, has five equal narrow ribs on each half, with an oil vitta between each and two on the commissure or face of contact with the other pericarp (q.v.).

Parsnip (*Pastinaca sativa*), a biennial British Umbelliferous plant, cultivated at least since the days of the Emperor Tiberius. In the Channel Islands its conical tap-roots reach eighteen inches in length and four to five inches in diameter. They are cream-coloured, sweet and aromatic, but of less dietetic value than the potato. The leaves are once pinnate, with oval bright-green leaflets, downy underneath when wild; and the flowers are yellow, and in large terminal, flat, compound umbels, on stems three or four feet high.

Parsons, ROBERT (1546-1610), English Jesuit, was born in Somersetshire and educated at Oxford, where he became fellow and tutor of Balliol. He was compelled to leave the university on account of his opinions, and went to Padua to study medicine. Eventually, however, he was ordained, and entered the Society of Jesus. In 1580 he and Father Campion were sent to England, the former disguised as a merchant. He left it a year later, when Campion was arrested, and went to France. Between this time and the Armada expedition he was busy with political intrigues. Between 1589 and 1593 he organised several seminaries for English Roman Catholics in the Peninsula and France, and was himself some time rector of the English College at Rome, where he died. In his later years his influence with the Pope was violently assailed by the secular priests.

Parthenogenesis is the method of reproduction in which the ovum, or female element, can develop without being fertilised by a spermatozoon or male element. Such cases are comparatively rare, but occur among the Rotifers or Wheel Animals, the Crustacea, as in the so-called "summer-ova" of Cladocera, and in the fresh-water Branchiopod known as Apus; and among the insects as in the Gall-flies (*Cynipidae*), the Plant-lice (*Aphidae*), and in the worker bees and wasps.

Parthenon, the name given to the Temple of Athene at Athens. It was the work of Callicrates and Ictinus, with the help of Pheidias, and was made of Pentelic marble. In 1687 it was reduced to its present state during the siege, by a Venetian shell, when it was a Turkish magazine. It is the finest specimen of Doric architecture.

Parthia, an ancient kingdom, forming part of what is now northern Persia, had Hyrcania as its northern, and Bactria and Media as its eastern and western boundaries, the Iranian deserts lying to the south. Its inhabitants came from Scythia, and were subject to their neighbours until in the middle of the 3rd century B.C. Tiridates incorporated Parthia with Hyrcania. Mithradates I. (171-38 B.C.) freed himself from all dependence on Syria, and conquered Bactria, Media, and Babylonia. His successor repelled the attacks of his country's former suzerain, but Parthia soon after became tributary to the Scythians. From the middle of the 1st century B.C. till the 3rd century A.D. a long struggle was carried on with Rome. In 218 the Emperor Macrinus was not only defeated, but obliged to pay a heavy sum to the victors. The

Parthian power came to an end a few years later, when Ardashir, the Persian, conquered it.

Partick, a suburb and parliamentary division of Glasgow, is situated 3 miles to the north-west on the Kelvin river. Shipbuilding is the chief industry.

Particular Average, a term used in marine insurance to signify the contribution which underwriters must make in case of partial loss by perils of sea.

Partridge, any bird of the gallinaceous genus *Perdix* of the Grouse family (*Tetraonidae*), with three species, ranging over the Continental Palæ-arctic region. The name is also applied to the birds of the genus (or sub-genus) *Caccabis*, distinguished by a rudimentary spur, and is sometimes

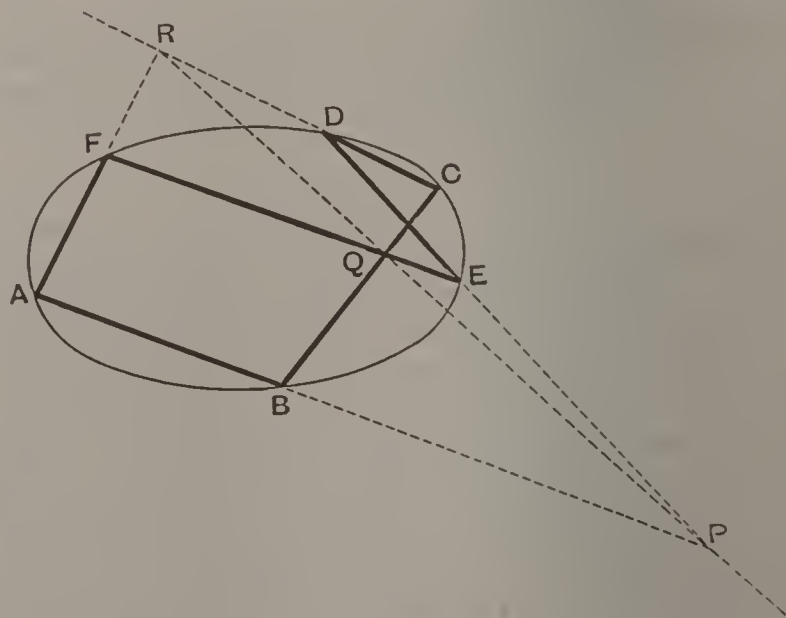


PARTRIDGE (*Perdix cinerea*).

extended to the sub-family *Perdicinae*, which includes the American Partridge and the Quail. In these birds the legs are bare and the nostrils naked, with a horny skin on the upper margin. The Common Partridge (*P. cinerea*) is a well-known British game bird, with a close time from February 1 to August 31. The male is about 12 inches long, and the female somewhat less; the head and throat are light yellowish chestnut; breast bluish-grey, freckled with blackish-brown, and on the lower part a brownish-red horseshoe or crescent, which is much smaller, or absent, in the hen-bird. The sides are barred with chestnut, and the back marked with brownish-black lines of brownish-yellow and grey. These birds frequent open and cultivated ground, and are rarely found in woodland; they feed on grain and seeds, insects and their larvæ, ants' "eggs"—really the pupæ—and, when these fail, clover or any tender leaves. The flight is rapid, but never high or long-sustained; it consists of several quick strokes to give impetus, and then the bird skims along with extended wings. Pairing takes place about February. The nest is usually a hollow in the ground, and contains from ten to sixteen eggs, yellowish-brown in colour, and the young come out in July. Both parents employ stratagem to attract strangers away from the nest or young brood. Game-preservers often hatch partridge eggs under hens, and the young are reared on ants' "eggs." The Red-legged or French Partridge (*Perdix*, or *Caccabis rufa*), native in southern Europe, is now naturalised in East Anglia, where it is said to have almost driven out the native species.

Pascal, BLAISE (1623–62), was born at Clermont-Ferrand. When he was seven years old his father, who was his teacher, went to live at Paris, where the child gave evidence of his powers by writing an *Essay on Conic Sections* at the age of sixteen. The family went to Rouen, where the father was appointed intendant, in 1641; and here Pascal first came into connection with the Jansenists and underwent his first "conversion." In 1647 he published *Nouvelles Expériences sur le Vide*, and in this year was visited at Clermont by Descartes. In 1650 he returned to Paris, and saw much society, until his second "conversion," four years later, from which time he began to be much at the Convent of Port Royal and to lead an ascetic life. Early in 1656 he undertook the defence of Arnauld, the leading member of that house, who had been condemned for his Jansenism by the Sorbonne, in the first of the *Lettres à un Provincial*, which was written under the pseudonym, "Louis de Montalte." It was followed by 17 others. As time went on, Pascal became more and more ascetic. His health had always been poor, and he died, worn-out by hard study and severe discipline, having barely reached middle age. Pascal was equally great as a mathematician and as a philosopher. He solved the problem of the quadrature of the cycloid, and founded the doctrine of probability; and by the experiments which he planned on the Puy de Dôme, first showed that the height of the mercury column in a barometer decreases when it is carried upwards through the atmosphere. His *Lettres Provinciales* (inaccurately so called) are equally admirable for their logic, their lightness of touch, and their inimitable style, which delighted Bossuet and Voltaire alike. The posthumous *Pensées* have been claimed by some as a sketch of an intended apology for Christianity; while others, like Cousin, have discovered in them proofs of the possession by the writer of a most daringly sceptical mind.

Pascal's Theorem was enunciated when its author was only a boy of sixteen, and first



PASCAL'S THEOREM.

appeared in a short essay published in 1640. It states that if a hexagon be inscribed in a conic the

intersections of opposite sides are three points in a line. This line is called the Pascal line. Any six points may be chosen, and they may be taken in any order to form a hexagon; hence, the hexagon may assume the most curious shape, quite different from the convex figure occurring in Euclidian geometry. In the adjoining figure *A B C D E F* is the hexagon; the opposite sides *A B* and *D E* meet at *P*, *B C* and *E F* meet at *Q*, while *C D* and *F A* meet at *R*. The points *P Q R* are seen to be collinear, *P R* being the Pascal line. Those same six points may be taken in many different orders, giving, in fact, as many as sixty different hexagons with a Pascal line for each. If five points *A B C D E* are given they are sufficient to completely determine the conic which shall pass through them; hence, if any line be drawn through one of these points—*E*, for example—we can from Pascal's theorem find a point *F* on this line which shall also lie on the conic. Since this can be repeated any number of times, we can obtain any number of points on the conic and so be enabled to draw the curve.

Pas de Calais, a department in the north of France, bordering on the Straits of Dover, which are so called by the French. The total area is 2,550 square miles, and the coast-line 80 miles long. Boulogne and Calais have good harbours. Fishing, turf-cutting, and mining are the chief industries; and in the towns are tanneries, iron-foundries, beet-factories, and glass-works. There are many rivers and canals. Arras is the capital.

Pasha, a title of high rank in Turkey and Egypt, used after the proper name, formerly pertaining to Turkish princes of the blood, now conferred on high civil or military officers. Military pashas used to be distinguished by standards of one, two, or three horse-tails, according as they were generals of brigade, of division, or in command. The word used to be also found in the form *basha*(*v*).

Paskevitch, *IVAN FEODOROVITCH* (1782–1856), a great Russian general, was a native of Poltava. He served against the French in Austria, and 1812 in defence of his own country, and also in the War of Liberation. For his services as commander-in-chief in the Persian War he was created Count of Erivan (1828). After serving with distinction in the Turkish War which followed, he reached the height of his reputation by putting down the Polish rising of 1831, after which he was made Prince of Warsaw and Governor of Poland. In 1848 he assisted Austria against the Hungarians, and forced Görgei to surrender at Vilagos in 1849. His last command was in 1854 on the Danube, when he was wounded at Silistria and retired.

Passage, BIRDS OF. [MIGRATION.]

Passamaquoddies, North American Indians, a branch of the Algonquian family, who formerly occupied the coastlands about the New Brunswick and Maine frontiers, where the name still survives in Passamaquoddy Bay and river. Here a small group

lingered on till about the year 1825, when they appear to have died out.

Passau, a town in Bavaria, is situated on the right bank of the Danube close to the Austrian frontier. The suburbs are on the other side of the Inn, which here joins the Danube. The place has been a fortress and an episcopal see since the 8th



PASSAU.

century, and has belonged to Bavaria since 1803. It possesses a cathedral and a bishop's palace; and manufactures leather, boots, porcelain, parquet-floors and mirrors. Passau tiles are made at Obernzell. In 1552 an important agreement between German Roman Catholics and Protestants was signed at Passau.

Passenger Pigeon (*Ectopistes migratoria*), a native of temperate North America. The tail is very long, graduated, and pointed. The male is about eighteen inches in length; the upper parts generally blue, with metallic gloss on neck; under-surface brownish-red. The female is a little smaller, and her plumage is less brilliant. The flesh is valued for the table. The migrations of these birds are undertaken in search of food.

Passerine Birds, PASSERIFORMES, PASSERES, an order of Carinate birds, the limits of which differ somewhat in different classifications. Dr. B. Sharpe has enumerated the sections and families in his article on Birds (q.v.).

Passion-flower (*Passiflora*), the typical genus of the calycifloral order Passifloraceæ, mostly climbing plants with unbranched tendrils and scattered leaves, natives of warm climates, especially America. They were so named by Jesuit missionaries, who traced in them detailed symbols of our Lord's Passion. The palmately-lobed leaves are the outspread fingers of the mocking multitude; the tendrils, the scourges; the ten segments of the

perianth, the Apostles in the absence of Peter and Judas ; the ring of coloured hair-like processes or *corona*, the crown of thorns or the aureole ; the five anthers splitting longitudinally, the five wounds ; and the three clavate stigmas, the three nails. The corona is connected with insect-pollination, the pollen being thrown upon it by the extrorse anthers. Both stamens and ovary are carried up on a gynandrophore (q.v.), and the stalked nuculane (q.v.) has a hard rind and numerous seeds, embedded in a fleshy, edible, but mawkish pulp. Many species are grown for their beauty, and numerous hybrids have been produced. The fruits of *P. quadrangularis*, the granadilla (q.v.) are brought to market occasionally. Those of *P. macrocarpa* sometimes weigh as much as eight pounds.

Passover (a translation of the Hebrew PASCH[E], PASSE), the name of the great festival of the Jewish Church, celebrated on the evening of the 14th day of the month Abib or Nisan in commemoration of the Exodus (q.v.), and more particularly of the passing over by the destroying angel of the Israelite's houses marked with the blood of the paschal lamb. Every householder then eats with his family the paschal lamb and unleavened bread. The Christian Easter has been made contemporaneous with it.

Passport, a certificate of identity and nationality, etc., issued from the Foreign Office of his country to a person about to travel, and countersigned by the representatives of his country in the states he purposes to visit. The document has to be shown on demand to the local authorities, and claims aid and protection for the bearer. Originally the word meant a written permission to pass through a port into the town or country to which the port belonged. Hence passports for goods, which relieve them from the usual duties, are still issued, and ships may have passports for their freight. The term is also applied to the certificates of identity and domicile without which the natives of some countries, such as Russia, may not travel in their own country, and which the police can at all times ask to see.

Pasta, GIUDITTA (1779-1865), was the daughter of an Italian Jew named Negri. Her first appearances on the operatic stage were not successful, but at Verona in 1822 the tide turned, and from 1825 to 1833 she sang with much applause in Paris, London, and other cities. Her best impersonations were La Sonnambula, Medea, Semiramide, and Giulia. Her husband was a singer. From her retirement till her death she lived at Como.

Pasteur, LOUIS, was born in 1822, and educated at Besançon, the École Normale, and the Sorbonne, where in 1867 he became professor of chemistry. As early as 1856 he had received the Rumford Medal of the Royal Society for his researches in connection with the polarisation of light. He discovered the existence of a micro-organism in impure tartrate of lime, and showed that other fermentations were due to similar living substances. He also turned his attention to

diseases of silkworms, and investigated the fermentations of beer and wine. For these experiments and the practical remedies which he proposed as their outcome, Pasteur was in 1874 awarded an annuity of 12,000 francs by the French Assembly. Subsequently he made researches on the subject of hydrophobia, and suggested inoculation as a cure. Many cases were treated by him with success. His experiments in the phenomena of putrefaction confirmed the doubt as to the possibility of the demonstration of the theory of spontaneous generation. In 1882 Pasteur was chosen a member of the Académie Française, and four years later the Pasteur Institute was established in Paris.

Paston Letters, THE, a collection of letters and papers pertaining to the Paston family, of Paston, in Norfolk, dating from the reign of Henry V. to the end of the reign of Henry VII., of which four volumes were published by Sir John Fenn, 1786-88, and a fifth was edited by Sergeant Frere, 1823. These papers were sold by William Paston, second and last Earl of Yarmouth, became part of the Le Mere collection of papers, and then passed through two hands before their purchase by Mr. Fenn. Most of the originals of the four earlier volumes have been lost, and those of the fifth were mislaid for years, but were found in 1865. They afford valuable illustrations of history, law, and manners.

Pastor, a genus of Starlings, with a single species (*P. roseus*), from western Asia. The head is crested, and the general plumage is bluish-black with some pink on the back and under-surface. They are sometimes called Locust-birds, from their fondness for these insects.

Pastoral Staff, a staff denoting authority, borne by, or before, prelates, abbots, and abbesses. In the Greek Church the head is generally in the form of a T-cross, which sometimes has the arms turned up to form a crescent. In the Western Churches the head is cruciform, or the staff is a conventional representation of a shepherd's crook. [CROZIER.] The scarf often attached to this staff was called the *sudarium* (q.v.).

Pasture, land on which live-stock grazes ; meadow-land. The phrase *permanent pasture* specifically excludes arable land on which cattle graze when it lies fallow, or when green crops have been sown for food. The term is sometimes applied to the herbage on which live-stock grazes.

Patagium, the membrane arising from the sides of the body and connecting the fore and hind limbs in the flying lemurs, flying squirrels, etc. It acts as a natural parachute, and by its aid these animals can take long leaps from above downwards.

Patagonia, the southernmost part of the continent of South America, is separated from the island of Tierra del Fuego by the Strait of Magellan. Late in the 16th century Sarminento da Gamba founded Spanish settlements at Nombre de Dios and San Felipe (now Port Famine), and about the same time Drake was in these regions. Further

explorations were made by Davis, Narborough, and Falkner; while, later still, Fitzroy, Darwin, and Musters, have given us some scientific knowledge of the country. Patagonia is about 1,000 miles long, and nearly 500 broad in the widest part. The larger part, from the mountains to the Atlantic, consists, except in the immediate neighbourhood of the rivers, of barren undulating plains, occasionally varied by rocks and salt lakes. Close to the Andes, however, there is some fertile land. The chief rivers, which all flow east, are the Negro, the Chupat, and the Chico. Large inlets on the eastern coast are the Gulf of St. Matias, and the Gulf of St. George. Most of eastern Patagonia, as far as the Andes, is now considered Argentine territory. The climate for a great part of the year is dry. Horses and cattle are bred in some regions. The chief animals are the guanaco, the rhea, and the tuco-tuco, pumas, foxes, and skunks being also common. There are many large birds, such as the condor and the flamingo. Western Patagonia belongs to Chile. It consists of the country between the Andes and the coast, and a line of islands, of which Chiloe, the members of the Chonos Archipelago, Wellington, Hanover, the Adelaide Archipelago, and Santa Inez, are the chief. The climate here is very moist, rain or snow falling in the south nearly every day. Among the chief mountain peaks are Minchinmavida and Corcovado, two volcanoes between 7,000 and 8,000 feet high; Monte San Valentin, nearly 12,700, and Chalten or Fitzroy, a volcano over 7,000 feet. Good timber is obtained from the mighty forests, and some coal is found. The population is scanty, but Chilian immigrants are coming in. At Punta Arenas Chile has a penal settlement. [ARGENTINA, CHILE, TIERRA DEL FUEGO, ETC.]

Patagonians, South American aborigines, who are thinly scattered over the pampas of Argentina from about the Rio Negro to the extremity of the continent, and who are represented in Tierra del Fuego by the Onas. [FUEGIANS.] The Patagonians, so called by Magellan from the large feet (*patagon*) of the animal-skins enveloping their legs, call themselves Ahonicanca or Chonek in the north; Inaken, Huaycuru, or Piyoche, in the south; and all have now generally adopted their Araucanian name, Tehuelche (*i.e.* "South-Easterners"), in reference to the position of their domain south-east of Araucania (South Chili). Physically they differ little from the normal American type, except in their larger stature, the mean being little, if at all, under 6 feet. Although the reports of travellers vary considerably on this point, there can be no doubt that the Patagonians are the tallest people in the world, exceeding the Eastern Polynesians, the Zulu Kaffirs, and all other Africans on an average by at least two inches. The head, also, is very large, massive, and brachycephalic (round), from which it appears that they are not the aborigines of the pampas region, the remains of their predecessors being distinguished by small dolichocephalic (long) heads and short frames, like those of the present Fuegians. The Patagonians are essentially wild nomads, living in *toldos* (tents), tilling no land, keeping no domestic

animals except the horse since its introduction from Europe, and depending for their subsistence entirely on fruits, herbs, roots, and game, especially the guanaco and rhea, which they pursue on horseback, and capture with the bola and lasso. They speak a stock language of highly polysynthetic structure, but in other respects entirely distinct from Araucanian and all other American tongues. They worship Ashekenat-Kanet, a great spirit, author both of good and evil, and believe in an after-life, where all will enjoy everlasting happiness: hence with the dead are buried all those objects that may be of use to them beyond the grave. The Patagonian domain is being slowly encroached upon by Argentine settlers from the north, and their numerous tribes at present (1894) number scarcely more than 25,000.

Patan, a town of Guicowar, India, in which there are manufactures of swords, pottery, and silk, stands on the site of the ancient Anhilwara. It is surrounded by high walls and interesting architectural ruins.

Patchouli, the volatile oil distilled from the leaves and shoots of *Pogostemon Patchouly*, an undershrub belonging to the order Labiatae (q.v.), and native to Sylhet, Malacca, and Penang. It is used in India to scent tobacco, hair-oil, shawls, and Indian-ink, and in Europe for sachets and other perfumery.

Patella, or KNEE-CAP. [KNEE.]

Patella, the genus of Lamellibranchiata including the common limpet.

Patent, Patent Right. A patent right is a privilege granted by the Crown to the first inventor of any new contrivance in the manufactures, that he alone shall be entitled during a limited period to benefit by his own invention. It is so called because the instrument by which it is bestowed is always in the form of *letters patent*, which is the established mode of royal grant. To confer on any individual the exclusive right of carrying on a particular trade or manufacture is in general beyond the lawful bounds of the royal prerogative, but an exception has always been made in favour of inventors of new manufactures, because with regard to them grants of exclusive privilege for a reasonable period, while they tended to encourage useful ingenuity, encroached on no right of which others were already in possession. In accordance with this principle the Statute of Monopolies, passed in the reign of James I., excepted from its general declaration against monopolies all letters patent for the term of fourteen years or under, by which the privilege of sole working or making any new manufactures within this realm, which others at the time of the grant shall not use, shall be granted to the true and first inventor thereof, "so as they be not contrary to law, nor mischievous to the State, nor to the hurt of trade, nor generally inconvenient." Since this statute no patent right can be valid unless it come within the terms of the above exception. Therefore no patent right can be legally granted in the first instance

for more than fourteen years, the subject must be "a new manufacture within this realm," and it must be an article fabricated by the hand of man, though a patent may be taken out not only for an entire article, but for an addition by way of improvement to one already existing, or even for a chemical process of production. The above statute has also added as a condition that it must be such as "others at the time of granting such letters patent shall not use." If a patent, therefore, be granted for an article already used or known or communicated to the public in this country, whether the prior use or discovery be known to the patentee or not, the grant will be void. But, on the other hand, it is sufficient that it be new *within this realm* at the time the patent is granted, and the previous notoriety of the article in a foreign country is no objection to the validity of the patent, and the grant also can be made only to the "true and first inventor," the word *inventor* implying some exertion of ingenuity and some difficulty surmounted, so that when the new manufacture is of an obvious character, requiring no skill or contrivance for its production, it is not the fit subject-matter of a patent. As to being the *true* and *first* inventor, no one can claim this character if it appear that the novelty in question was first suggested to him by some other person in this country; yet where the secret is acquired abroad by one who afterwards introduces it into this realm, he is considered by law as the true inventor, for it is immaterial whether the benefit bestowed on the public be the result of a man's travel and observation or the fruit of his original genius. In the case of two simultaneous discoveries, he who first procures a patent before the matter is made public is entitled to the privileges it confers. As to obtaining a patent, the application is made by petition contained in and supported by a solemn declaration that the petitioner is the true and first inventor, and that the invention is not in use in this country by any other person, to the best of his knowledge and belief; and the application, which must be left at (or sent to) the Clerk of the Patents, must be accompanied by either a provisional or a complete specification, the provisional specification describing the nature of the invention and being accompanied in general by drawings illustrative thereof, and the complete specification particularly describing and ascertaining the nature of the invention and in what manner it is to be performed or put in use, and being accompanied in general by drawings illustrative thereof, or else referring to the drawings thereof which accompanied the provisional specification. The complete specification, if not left with the application, must be sent not later than nine months (extendable) from the date of the application, otherwise the application is taken to have been abandoned. The application is then referred to the Comptroller of Patents, who inquires and reports thereon.

Pater, WALTER HORATIO, was born in London in 1839, and educated at Canterbury and Oxford, where he was elected fellow of Brasenose in 1865. He afterwards travelled in France, Italy, and

Germany. He has published *Studies in the History of the Renaissance* (1873), *Marius the Epicurean* (1885), *Imaginary Portraits* (1887), and *Appreciations; with an Essay on Style* (1889).

Pater Noster, the Lord's Prayer, so-called in the Latin Church from the first two words of the Vulgate version, meaning "Our Father." Also one of the large beads in a rosary at the telling of which the said prayer is repeated, and hence the rosary (q.v.) itself. In fishing, a line set with hooks and shot at regular intervals.

Paterson, WILLIAM (1658-1719), projector of the Bank of England, was the son of a farmer at Tinwald, Dumfriesshire. He lived for some years in the Bahamas, and returned to Europe to carry out the Darien scheme. Returning to London about 1685, he soon made a fortune in trade, was instrumental in forming the Hampstead Water Company in or about 1690, and in 1694 founded the Bank of England. Personal jealousy and his plan for forming an Orphan's Bank soon compelled his retirement from the directorate, and he then went to Edinburgh, where he elaborated his scheme for the settlement of the isthmus of Darien (q.v.).

Pathans. [AFGHANISTAN.]

Pathology (Greek, *pathos*, "disease"), the science which deals with life under abnormal conditions. This science was for the most part limited in former days to the study of symptoms and treatment, but within the last century there have been considerable additions to the knowledge of the anatomy of disease, the naked-eye appearances and the tissue changes revealed by the microscope having been studied carefully. The subject of pathological chemistry has also grown up, and the study of physiology, which deals with animal functions in health, has greatly modified the notions concerning diseased processes. The germ theory, moreover, has led to many new developments in pathology. The science deals with such subject-matters as Atrophy, Hypertrophy, the various forms of Degeneration (q.v.), Tumour-formation [TUMOURS], Inflammation (q.v.), and the relation of parasites to disease.

Patmore, COVENTRY KEARSEY DEIGHTON, was born in 1823. His father, P. G. Patmore, was author of *Literary Reminiscences*. From 1847 till 1868 Mr. Coventry Patmore was on the staff at the British Museum. Since that time he has lived in retirement in Sussex. In 1844 he published some poems, and in 1850 contributed to the Pre-Raphaelite *Germ*. In 1853 appeared *Tamerton Church Tower and Other Poems*, and in the following years the first part of the poem which was published as a whole in 1866 as *The Angel in the House*. In 1877 *The Unknown Eros and Other Odes* was issued.

Patmos (PATINO), an island of the Ægean Sea belonging to the Sporades group, is situated to the south of Samos. The surface consists mostly of barren rock, but it is inhabited by some 4,000 Greek sponge-fishers. The ancient monastery of St. John the Divine at the top of a mountain commemorates the exiled author of the Apocalypse.

Patna, a native state of the Central Provinces, with a capital of the same name, having an area of 2,400 square miles.

A city in the presidency of Bengal, stands (in a district of the same name) on the left bank of the Ganges about 140 miles east of Benares. Its ancient name was Pataliputra, and it was called Palibothra by Megasthenes, the Greek historian, who visited it in the 4th century before Christ. After the massacre by Mir Kassim in 1763, it was annexed by the British East India Company. A Government granary was established in 1786. Patna, which is the seventh city of Hindustan, is of great commercial importance. Salt, rice, cotton, oil-seeds and spices are exported, and the Indian Government has several opium factories in the place. The chief buildings are the mosque of Sher Shah, the shrine of Shah Arzani, Patna College, and a Mohammedan college. In 1857 a mutiny broke out at Dinapur, a military station in the environs.

Paton, SIR JOSEPH NOEL, LL.D., was born in 1821 at Dunfermline. He studied at the Royal Academy, London, and in 1845 gained, with his *Spirit of Religion*, one of the three premiums awarded in the Westminster Hall competition. In 1850 he became a member of the Royal Scottish Academy. Chief among his other pictures are *The Pursuit of Pleasure* (1855), *Dawn—Luther at Erfurt* (1861), *Faith and Reason* (1871), and *Lux in Tenebris* (1879). He also illustrated *The Ancient Mariner*, *The Water Babies*, and *Lays of the Scottish Cavaliers*, and published two volumes of poems. He was knighted in 1867.

Patras (anciently PATRAI) stands in the north of the Morea at the entrance to the Gulf of Corinth. It became an archiepiscopal see in the 4th century, and has been from a very early date an important fortress. It was twice besieged by the Spaniards in the 16th century, and in the Greek War of Independence played an important part. It was much injured by an earthquake in 1820. From its harbour, which was much improved in 1880, large quantities of currants, as well as olive oil and wine, are exported.

Patriarch, the title both in the Eastern and in the Latin Church of metropolitan bishops (q.v.) of the highest rank, the Pope only excepted. The title was applied to the heads of the Jewish Sanhedrim after the captivity, and originally to the founders of the Hebrew race—Abraham, Isaac, Jacob, and his children—and also to the antediluvian heads of families mentioned in Genesis.

Patrician, a member of the superior order of citizens in ancient Rome, which order consisted of the families of the early *patres* or senators. The title was conferred by the later Roman emperors as a distinction, without regard to its original meaning. It was occasionally borne by sovereigns and dignitaries in the Middle Ages.

Patrick, ST. (or SUCCAT?), the Apostle of Ireland, lived in the 5th century. Exactly when and where he was born is uncertain. When fifteen he was carried off by a robber band and sold to an

Irish chief named Milchu, who lived in Antrim near Broughshane, where is now Ballyligpatrick. After six years Patrick escaped to France, and lived as a monk at Tours and at Lérins. In 432 he went as a missionary to Ireland, first, perhaps, landing in Wales. Landing at Wicklow, he went north to County Down, where he converted a chief named Dichu, who gave him Sabhall, or Saul, his first church. He next preached at Tara before Laoghaire (Leary), the king, and thence visited northern Connaught and other parts of Ulster. His preaching was highly successful, and in the course of about twenty years he is said to have baptised 12,000 persons and founded more than 300 churches. It was he who made Armagh the metropolitan see of Ireland. The date of his death, like that of his birth, is extremely uncertain, but was between 460 and 493. He was buried at Downpatrick; many other Irish places bear his name. The *Book of Armagh*, in Trinity College Library, contains St. Patrick's *Confessions*.

Patrick, ORDER OF ST., the Irish order of distinction formed in 1783 by George III. It comprises the sovereign, the Lord-Lieutenant of Ireland, and twenty-two knights.

Patrick, SIMON (1626–1707), a learned theologian, was born at Gainsborough and educated at Cambridge. At the time of the Great Plague he was rector of St. Paul's, Covent Garden, and subsequently became Dean of Peterborough and Bishop of Chichester and Ely (1691). He was author of many expository works, and left an *Autobiography*, which was first printed in 1839.

Patron, originally a Roman patrician in his relation to his clients—i.e. to his freedmen and such of the commonalty as were under his protection; hence a saint who is regarded as the special protector and benefactor of a person or persons, a family, a nation, or a class. *Ecclesiastically*, the person who holds the advowson of a benefice.

Patteson, JOHN COLERIDGE (1827–71), Bishop of Melanesia, was the son of Justice Patteson and a great-nephew of S. T. Coleridge. He was educated at Eton and Oxford, and in 1855 accompanied Bishop Selwyn to the Melanesian Islands, of which he became bishop in 1861. His life was one of unwearied devotion both to the spiritual and physical wants of the natives. He was murdered by the inhabitants of one of the Santa Cruz group, who apparently mistook his ship for that of a kidnapping party.

Patti, ADELINA MARIA CLORINDA (b. 1843), *prima donna*, of Italian extraction, was born at Madrid, but removed with her parents at an early age to America. After producing a favourable impression as Lucia at New York in 1859, she made her *début* at Covent Garden as Amina in 1861, and her brilliant success in this and other Italian *rôles* speedily established her reputation. She has been equally well received in Paris, Vienna, St. Petersburg, and other European capitals, as well as both in North and South America. She married her second husband, the tenor Nicolini, in 1886.

Pattinson's Process is the method which is usually adopted for desilverising lead, and is so effectual that silver, if present in the lead to the extent of only two or three ounces to the ton, may be profitably extracted. The process depends on the fact that when argentiferous lead is melted and allowed to cool the portions that solidify first are not so rich in silver as the still liquid portion. The lead is hence melted in a number of pots arranged in line, each about five or six feet across. The crystals solidifying first are ladled out and passed into the pot on the right until two-thirds of the lead has been so transferred, the remainder being passed to the left. By this means at the extreme left a highly argentiferous lead is obtained, from which the silver is obtained by *cupellation* (q.v.).

Pattison, MARK (1813-84), was the son of the rector of Hauxwell, near Richmond, in Yorkshire. He matriculated at Oriel College, Oxford, in 1832, and was elected to a fellowship at Lincoln College in 1839. At this period he belonged to the advanced wing of the Tractarian party, and showed his theological bent by twice gaining the Denyer prize (1841-42). He translated for Pusey's *Library of the Fathers*, and followed Newman on his retirement to Littlemore, but "did not share in the crash of 1845." In his reaction from the Oxford Movement he was drawn as forcibly towards latitudinarian views as he had previously been in the opposite direction, and his life henceforward is a history of ever-widening efforts after intellectual culture. His work at Oxford was retarded for ten years by his failure to obtain the rectorship of his college in 1851, but after his election in 1861 he again devoted himself to university reform. He also took a deep interest in education generally, and acted on the Duke of Newcastle's Commission of Inquiry into Elementary Education, publishing a *Report* (on Germany) in 1859. His books, few in number, are remarkable alike for their deep erudition, earnest thought, and vigorous style, the best known being *Isaac Casaubon* (1875) and *Milton* (1879), in the "*English Men of Letters*" Series. His *Memoirs* are an interesting autobiography. His sister, DOROTHY WYNDHAM PATTISON ("Sister Dora") (1832-78), became widely known and loved in the Black Country during the thirteen years (1865-78) she laboured as hospital nurse at Walsall.

Pau, the capital of the French department of Basses Pyrénées, is situated on the right bank of the Gave de Pan, 20 miles W.N.W. of Tarbes. It stands on the edge of the plateau 623 feet above the sea, commanding a magnificent view of the Pyrenees to the south. Pau was the ancient capital of the kingdom of Béarn. The castle, which was the birthplace of Henri IV., is a noble building flanked by six square towers, one of which is 113 feet in height. Bernadotte was also born at Pau. The importance of the town is now mainly due to its celebrity as a health-resort, especially in the winter. Chocolate and linen are manufactured.

Paul, the name of five popes:—

PAUL III. (ALESSANDRO FARNESE), (1468-1549), succeeded Clement VII. in 1534. Although he was

a dissolute and self-seeking prelate, he showed both zeal and prudence in the measures he took to subvert Protestantism. In 1540 he gave his sanction to the Jesuit order, and in 1545 convoked the Council of Trent. He issued a bull excommunicating and deposing Henry VIII. (1538), and refused to end the religious struggle in Germany by countenancing the Interim of Charles V.

PAUL IV. (GIOVANNI PIETRO CARAFFA), (1476-1559), succeeded Marcellus II. in 1555. He was conspicuous before his accession for his ascetic life and his zeal for reform, and, as Pope, strenuously endeavoured to enforce his views of clerical duty and public morality. At the same time he was determined in his opposition to all that he conceived to be heresy, establishing the Inquisition at Rome and issuing the first *Index Expurgatorius* (q.v.).

PAUL V. (CAMILLO BORGHESI), (1552-1621), succeeded Leo XI. in 1605. He was engaged in a long struggle with the republic of Venice, which sprang out of the claim of the clergy to freedom from civil jurisdiction. It was at last brought to a close through the interference of Henri IV. of France in 1607.

Paul, ST., originally SAUL, the great apostle of the Gentiles. He was born at Tarsus, in Cilicia, a town famous as a place of education and made a free city by the Emperor Augustus in recognition of the fact that its inhabitants in the Civil Wars had espoused the cause of Julius Cæsar. The claim which the apostle successfully asserted on several occasions to Roman citizenship depends, however, not on this, but on other circumstances which we can only conjecture. To his early education at Tarsus may be traced the acquaintance with Greek literature which his writings occasionally exhibit. Cilicia was celebrated for its breed of goats, the hair of which was employed at Tarsus in various manufactures; in particular, tents were made with it, and we find St. Paul, after his conversion to Christianity, described as by trade a "tent-maker." This fact throws no light upon the social *status* of his parents, or his own early circumstances, for it was customary in the wealthiest Jewish families for children to be taught a trade. He himself tells us that he was a Hebrew of the Hebrews, of the tribe of Benjamin; and that he had been "brought up at the feet of Gamaliel," the wisest as well as the most tolerant of Jewish rabbis. From this we may infer that he had migrated early in life to Jerusalem. His enthusiastic temperament had not been responsive to the milder influences of his teacher, Gamaliel, whose counsel to the Sanhedrin was to leave the Christian movement alone. Saul, on the contrary, first appears in history as the young man who took care of the outer garments of those who were stoning to death the first Christian martyr, St. Stephen. Soon after this, armed with powers from the Jewish authorities at Jerusalem, he set out with a band of followers, intending to seize and bring to Jerusalem converts to the new faith at Damascus; but as he neared that city, a light from heaven smote him to the earth, and blinded him for a time, and he heard the voice of the Saviour: "Saul, Saul, why persecutest thou Me?" He was taken into

Damascus, where, by Divine command, a Christian convert visited him, on whose coming Saul received his sight and was baptised. He now joined himself to the Christian community at Damascus, and even preached Christ in the synagogues. From Damascus also he visited some part of Arabia, returning to the town once more. The Jews attempted his life; but from the window of a house which was built on the city wall he was let down by night in a large network fishing-basket, and so made his way to Jerusalem, where his attempt to join himself to the Christian society there was at first received with suspicion, until Barnabas spoke for him and vouched for his conversion and his zeal. At Jerusalem, as at Damascus, his desertion of their side and ardent espousal of the other brought him into danger from the hands of the Jews, and he returned for awhile to his native Tarsus. Thence he was fetched by Barnabas to the Syrian Antioch to aid in the Christian movement there, and with Barnabas he carried relief to the believers at Jerusalem who were suffering from a famine. After their return to Antioch the apostle's missionary history begins. He and Barnabas, with Mark, Barnabas's cousin, went to Cyprus, where they, in spite of the opposition of the sorcerer Elymas, converted the Roman proconsul, Sergius Paulus. At this time it is that Saul begins to be called by the Gentile name of Paul by the sacred historian. Thence the three went to Perga, in Pamphylia, where Mark deserted them. From Perga, Paul and Barnabas went to the Pisidian Antioch, where St. Paul's preaching encountered strong opposition from the Jewish leaders—resulting, first, in his preaching only to the Gentiles in that place, and at last in his expulsion with Barnabas. Thence they came to Iconium and, being again endangered, passed to Derbe and Lystra, in Lycaonia. At Lystra St. Paul's healing of a cripple led to an attempt on the part of the heathen inhabitants to worship him and his companion as gods. After other vicissitudes, the missionaries ended their first journey by returning to the Syrian Antioch. Thence they were sent to Jerusalem, in consequence of an attempt by teachers thence to impose the rite of circumcision upon Gentile converts, and returned with an ordinance from the church there practically exempting such converts from the ceremonial part of the Mosaic law. St. Paul next undertook a second missionary journey; but Barnabas, wishing to take Mark once more, St. Paul dissented, on the ground of his previous desertion. In consequence, the former associates parted company; St. Paul started this time with Silas. He revisited Derbe and Lystra; there they took up the young Timotheus, went through Phrygia and Galatia, and, prevented by some Divine monition from going, as they had designed, to the southern shores of the Euxine, they found themselves at Troas, on the west coast of Asia Minor. Here St. Paul had the vision of a man of Macedonia, saying to him: "Come over and help us." They therefore crossed the Ægean Sea. At Philippi, as they went to the Jewish meeting-place by the river's side, St. Paul cast out the evil spirit from a possessed damsel who cried after them, and thus deprived her employers of a source of gain, in

consequence of which a stir was raised against the missionaries, and they were beaten and cast into prison by the authorities. While in prison they consoled themselves with hymns. The vivid story of the earthquake, the panic of the Philippian gaoler, his conversion, and the calmness and courage of the apostle and his companion, must be read in the Acts of the Apostles (chap. xvi.). It was here, in a town proud of its own immunities as a "Roman" colony, that St. Paul first asserted his claim as a freeborn Roman citizen, whom it was a crime to beat or to cast into prison uncondemned. Proceeding to Thessalonica, Paul and Silas made further converts, but departed in consequence of tumults there, leaving the nucleus of a church, to which, shortly afterwards, St. Paul wrote his earliest extant Epistle. St. Paul's work at Berea, the next town visited, was disturbed by emissaries from Thessalonica; he went, leaving Silas and Timotheus behind him, to Athens, where, amid the works of art there in process of restoration, he saw an altar with the inscription, "To some god unknown." This he took for the text of his wonderful address to the Stoics and Epicureans who met to hear him in the Areopagus. He made but few converts here, and went on to Corinth, a great commercial centre, through which passed the traffic between the Eastern and Western world. Here he was joined by Silas and Timotheus, and preached fervently, first in the Jewish synagogue, and then, when his teaching was rejected, to the Gentiles. He converted, however, Crispus, the chief ruler of the synagogue; and this and other instances of his power led the Jews to bring him before Gallio, the Roman procurator of Achaia, brother of the philosopher Seneca, who refused to deal with such matters, as entirely out of his jurisdiction. Thus, having founded a church—partly Jewish, partly Gentile—at Corinth, St. Paul went away to Ephesus, whither, after a brief visit to Jerusalem, he returned once more, to stay for more than two years; until his success in turning the inhabitants from the practice of magic arts and the worship of the goddess Artemis, to whom the famous temple, the pride of their city, was dedicated, roused a tumult against him, from which he escaped, and went once more into Macedonia, and revisited the churches which he had founded on the European continent. From Corinth he purposed to depart by sea, but his Jewish enemies lay in wait for him, and in consequence he returned through Macedonia, and from Philippi sailed to Troas. Anxious to reach Jerusalem for the feast of Pentecost, he took ship again, only breaking his journey to meet, at Miletus, the elders of the Ephesian church, of whom he took an affecting farewell. At Tyre St. Paul and his companions landed, and there, and again at Cæsarea, he received prophetic warning of the dangers that awaited him at Jerusalem. Nevertheless, he went fearlessly on his way. Arrived at his destination, he adopted reasonable precautions to show his own respect for the Mosaic law and his desire that *Jewish* converts should observe it; but, in spite of this, an outcry was raised against him within the Temple precincts, which he was falsely accused of desecrating. He

was rescued by the interference of the Roman soldiery in the garrison hard by, the tribune in command of which would have had him questioned under the scourge, but that he once more asserted that he was a "Roman." The tribune then brought the apostle before the chief priests, hoping thus to discover the truth about this *émeute*. St. Paul, in his pleading, adroitly divided his antagonists by pointing out that he was called in question on that doctrine of the resurrection which the Sadducees, in opposition to the Pharisees, rejected. Once more rescued by the tribune from Jewish hands and from a conspiracy of which timely discovery was made, St. Paul was next sent as prisoner to Cæsarea, to be tried before the proconsul Felix. His defence enlisted the sympathy of his judge, who heard him further on the faith of Christ, and trembled when he reasoned "of righteousness, temperance, and judgment to come." Yet St. Paul remained a prisoner for two years longer, when Felix was succeeded by Festus, who heard the case once more. On this occasion St. Paul appealed to the Roman emperor—a request to which the Roman governor, after once more (with Herod Agrippa, the Jewish tetrarch) giving him a hearing, was compelled to accede. It was necessary, therefore, that the prisoner should be sent to Rome. Of his voyage thither and shipwreck on the island of Malta we have a vivid account in the 27th chapter of the Acts of the Apostles. At Rome the prisoner was treated with consideration, being allowed to live in a sort of free custody with the soldier to whose charge he was given. He addressed his Jewish brethren in the city, endeavouring to dispel the prejudices against him, and during this, his first imprisonment, probably wrote his letters to the churches at Philippi, Colossæ, Ephesus, and to his friend Philemon on behalf of the fugitive slave Onesimus. That he was set at liberty, and visited the scenes of his apostolic labours again, only, however, to become a prisoner at Rome once more, is a necessary inference from passages in his Epistles to Timothy and to Titus, which only this supposition will explain. St. Paul was small in stature, with some physical deformity—his "thorn in the flesh"—the nature of which can only be conjectured. Concurrent tradition affirms that he was beheaded at Rome in the reign of the Emperor Nero. It is supposed that he was born a little later than that Saviour whom he so faithfully preached.

Paul I. (1754–1801), Emperor of Russia, was the son of Peter III., who was murdered when he was in his ninth year. During the lifetime of his mother, Catherine II., he was not allowed to take any part in public affairs. He became emperor on her death in 1796, and soon excited the greatest discontent by his despotic and arbitrary measures. At first he took part with the Allies against France, despatching Suvaroff to the seat of war; but in 1799 he formed an alliance with Napoleon. He was killed whilst an attempt was being made to seize him by a band of Russian nobles, who intended to force him to abdicate.

Paul of Samosata, an heresiarch of the third century, was born at Samosata, the capital of

Commagene, on the Euphrates. He became Bishop of Antioch in 262, and was supported in his heresy by Zenobia, Queen of Palmyra, who made him her chief minister. After the defeat of Zenobia by the Roman emperor Aurelian, in 272, Paul was deposed. His heresy consisted in denying the distinction of the three Persons of the Trinity.

Paulding, JAMES KIRKE (1779–1860), American author, was born in New York State. His works include an essay on *The United States and England* (1814), satirical sketches and humorous novels, such as *The Dutchman's Fireside* (1831) and *Westward Ho!* (1832), and a *Life of Washington* (1835). He was Secretary of the Navy 1837–41.

Pauli, REINHOLD (1823–82), the German historian of England, was born in Berlin, and studied there and at Bonn. From 1847 to 1855 he resided in England, acting for part of the time as private secretary to the Chevalier Bunsen. He was professor at Rostock (1857–59), Tübingen (1859–66), Marburg (1867–70), and Göttingen (1870–82) successively. His works include a *Life of King Alfred* (1851, translated 1852), a continuation of Lappenberg's *History of England*, extending from Henry II. to Henry III. (1853–58), *Pictures of Old England* (1860, translated 1861), and a monograph on *Simon de Montfort* (1867, translated 1876).

Paulinus (d. 644), first Archbishop of York, was sent from Rome by Gregory in 601 to assist Augustine in Kent. On the marriage of Ethelburga, daughter of Ethelbert of Kent, to Edwin of Northumbria, in 625, he accompanied the princess to her new home, having been previously consecrated bishop by Justus, Archbishop of Canterbury. After some difficulty, he prevailed on Edwin to call a meeting of his wise men, in which the arguments for and against the new religion were fully discussed, the result being that the king and his court received baptism in a wooden chapel, on the site of which afterwards rose York Minster (627). For six years he laboured with zeal and success amongst the Northumbrians, and received the *pallium* as metropolitan of the north from Pope Honorius; but after the defeat and death of Edwin at Hatfield (633) he returned with Ethelberga to Kent, and was appointed Bishop of Rochester.

Paulus, HEINRICH EBERHARD GOTTLÖB (1761–1851), German Rationalist, was born near Stuttgart. He was professor at several universities in succession, occupying the chair of ecclesiastical history at Heidelberg from 1811 to 1844. His chief work was his *Exegetisches Handbuch* (1830–33).

Paulus Diaconus (circa 720–95), the Lombard historian, was of noble birth, and received the best education the times could supply. His retirement to the monastery of Monte Cassino about 744 seems to have been due to the overthrow of the Lombard kingdom by Charles the Great. He subsequently resided for some years in France, and was patronised by Charles the Great, but returned to his convent before his death. His chief work was his *History of the Lombards*, extending to the death of King Liutprand, in 744.

Much of the material was taken from the histories of Secundus of Trient and Gregory of Tours.

Pauropoda, an order of Myriapoda, including only the genus *Pauropus*—described by Sir John Lubbock—and *Eupauropus*. They differ from their nearest allies, the Millipedes, in the small number of body segments and the few joints in the antennæ. They live among damp decaying leaves, and are small in size.

Pausanias, a Greek traveller and writer on topography, flourished in the 2nd century A.D., under Hadrian, Antoninus Pius, and Marcus Aurelius. He is supposed to have been born in Lydia. His *Hellados Periegesis*, a sort of guide-book to Greece, with descriptions of temples, sculptures, etc., and local myths, though possibly in great part a compilation, is full of value, both for the antiquary and the anthropologist.

Pausanias (d. circa 467 B.C.), a Greek general, was the son of Cleombrotus, King of Sparta, and acted as regent during the minority of his cousin, Pleistarchus, son of Leonidas. He led the Spartan contingent sent to aid the Athenians against the Persian army under Mardonius, and commanded the allied forces which gained the brilliant victory of Plataea (479). The Persians having been driven from Greece, he sailed with a fleet to Cyprus, which he freed from the Persian yoke, and afterwards captured Byzantium (477). Elated by his constant success, he now began to offend the allies by his arrogance, and at the same time entered into a treasonable correspondence with Xerxes, the Persian king, hoping with his aid to secure the sovereignty of Greece. After being twice recalled from Byzantium by the Ephors, and acquitted through lack of evidence, he was finally betrayed by a Helot, to whom he had committed a letter for Artabazus, the Persian satrap. He fled for refuge to the temple of Athene, and the Spartans blocked up the door, leaving him to die of starvation.

Pa-Utes (PAI-UTES), North American Indians, a distinct branch of the Utes, who form a main division of the Shoshonean family. All appear to be still in the nomad state, being scattered in small groups over the unsettled parts of south-east California and south-west Nevada. Total estimated population (1892), 2,300.

Pavement, a flooring, or the artificial surface of an area, road, or path, made of stones, flagstones, bricks, tiles, concrete, or wood resting on a prepared bed. Hence a footpath of such formation on the side of a street or road.

Pavia, a city of Italy, on the Ticino, two miles above its junction with the Po, and 22 miles S. of Milan by railway. The greater part of the ramparts, $3\frac{1}{2}$ miles in circumference, remains. The basilica of San Michele, recently restored, is a fine example of Lombardic architecture, dating probably from the 7th century. The Duomo, begun 1488 and still unfinished, contains the tombs of St. Augustine and Boëtius. The palace of the Visconti, a quadrangle of immense size, begun in 1360, was much injured by the French in 1527, who at the beginning of the

century had robbed the castle of its antiquarian treasures. The university, said to have been founded as a school by Charlemagne, was reconstituted in 1361. Pavia (called Ticinum up to the end of the 7th century) was founded by Gauls during the first Gallic immigration. It was the capital of the Lombard kingdom in the 7th and 8th centuries. In the struggles of the Guelphs and Ghibellines it usually sided with the latter, owing to jealousy of Milan, till in 1360 it passed to the Visconti family. Near this city Francis I. of France was defeated and taken prisoner in 1525.

Pawn, Pawnbrokers. Pawn signifies at the present day a pledge to a pawnbroker or person who keeps a shop for the purchase or sale of goods, and takes goods by way of security for money advanced thereon. Statutory regulations have been made preventing frauds and overcharges by pawnbrokers. Thus every pawnbroker taking a pledge for a loan not exceeding £10 is bound to give the pawner a pawn-ticket, specifying the charges for interest, etc., which he is allowed by the statute to make, the period within which the pledge may be redeemed, and he is also bound to keep account-books, showing all sales of pledges made by him. He has a statutory power of sale by auction. In other respects he is a bailee, like an ordinary pledgee. (See the "Pawnbrokers Act, 1872," by which previous Acts were repealed and the statute law on the subject consolidated.)

Pawnees, North American Indians, forming the chief division of the Caddoan family, though regarded by some as distinct from that connection. The original hunting-grounds of these renowned prairie Indians extended from the Niobrara river, Nebraska, to the Arkansas, though the boundaries fluctuated, and some of the tribes (Skidi) appear to have formerly dwelt east of the Mississippi. Four main divisions: Grand Pawnee, Tappas, Republican Pawnee, and Skidi (Panimaha or Pawnee Loup), all of whom were removed in 1876 to the Pawnee and other reservations, Indian Territory, where they appear to be dying out. Total population (1889), 176. Early in the 19th century they mustered as many as 2,000 fierce warriors, in constant feud with the Dakotans; but despite their warlike and even ferocious character, the Pawnees were the only North American aborigines who ever submitted to the state of slavery. Those captured by their enemies were constantly bartered as slaves, especially to the Franco-Canadian traders, and openly sold by them at the old station of Poskoïac, on the Saskatchewan river. (Bougainville, Powell, W. Lillie, Tassé.)

Pawtucket, a city of Rhode Island, United States, four miles N.E. of Providence by railway. The first American cotton factory was erected here by Samuel Slater in 1790 in consequence of the water power afforded by the river Pawtucket, which has a fall of nearly 50 feet.

Paxton, SIR JOSEPH (1803-65), architect and horticulturist, was born of humble parentage at Milton Bryant, near Woburn, Bedfordshire. He entered the service of the Duke of Devonshire as

gardener, and was eventually placed in charge of the gardens at Chatsworth, which he laid out with much skill on an entirely new plan. His experience in the construction of buildings of glass and iron enabled him to design the Crystal Palace, the primary purpose of which was to hold the Great Exhibition of 1851. It was subsequently removed to Sydenham and reconstructed, under Paxton's superintendence, as a place of popular entertainment. Paxton was Liberal member for Coventry from 1854 to 1865.

Pa-y, hill tribes, south-west China and north Burma, of Shan stock, though in Burma largely assimilated to the Burmese; two branches: *Diju* on the left, *Telon* on the right bank of the Upper Irrawady. The type is described by Kreitner as much finer than that of the surrounding Mongolic populations—dark horizontal eyes, straight nose, and Caucasian expression. (*Im Fernen Osten*, p. 959.)

Paymaster, the head of the paying department of the Treasury (Paymaster-General), of the army, or of the navy.

Payn, JAMES (b. 1830), English novelist, author of *Lost Sir Massingberd* (1864), *By Proxy* (1878), and some hundred other works. He became editor of *Chambers's Journal* in 1858, of the *Cornhill Magazine* in 1882, and has published *Literary Recollections* (1884).

Payne, JOHN HOWARD (1792–1852), actor and dramatist, was born at New York. From 1813 to 1832 he resided in London, producing numerous plays, in one of which—*Clari, or the Maid of Milan*—occurs the famous song, *Home, Sweet Home*.

Pea (*Pisum sativum*), the only distinct species of a genus of Leguminosæ (q.v.). It is a hardy annual, probably wild in south-eastern Europe, but cultivated from a remote antiquity, and now represented by numerous varieties. The whole plant is covered with a glaucous bloom. Though sometimes dwarf, it often climbs 8 or 10 feet by means of the clasping branched tendrils which terminate its scattered pinnate leaves. These leaves have each a pair of foliaceous stipules larger than their leaflets. The axillary flower-stalks bear one or two large white or pale-violet flowers of papilionaceous (q.v.) form, which are succeeded by pendulous, smooth, oblong, slightly-compressed pods with a hooked point. Each pod contains one row of several seeds which, when ripe, may be smooth or wrinkled, white, blue, or green. The cultivation of peas was introduced from Holland or France about the time of Henry VIII., but green peas were not much grown for the table till after the Restoration. Unripe or *green peas* contain more sugar and are more digestible, and *split peas* have the tough envelope of the seed removed. The varieties known as *sugar-peas* have fleshy pods which can be eaten like French beans. Peas are a most valuable flesh-forming food, containing as they do 22 per cent. of albuminoid matter, largely casein, to 51 per cent. of starch. *Pea-flour* is largely used in the form of *pea-soup* and *pease-pudding*. There are about 220,000 acres under peas in the United Kingdom, yielding 6 million bushels, and we import from 2 to 2½ million

cwts., valued at £600,000 annually, mostly from America. Pea-straw is a valuable fodder. The *field-peas* of farmers are sometimes distinguished as *P. arvense*. The *sweet-pea* of our flower-gardens (*Lathyrus odoratus*) belongs to a closely-related genus, as do also the various perennial *everlasting-peas*.

Peabody, GEORGE (1795–1869), philanthropist, born in Massachusetts, United States of America, after making a small fortune in the dry goods trade at Baltimore, became a banker in London (1843), and amassed immense wealth by his dealings in United States bonds during the Civil War. In addition to many other philanthropic schemes, he, in 1862, placed £150,000 in the hands of trustees for bettering the condition of the London poor; the sum was eventually increased to £500,000, and employed to erect model artisans' dwellings.

Peace as an international term denotes the normal conditions which prevail among civilised nations, and which are for the most part secured by treaties, such treaties, however, being terminable when any party to them has the desire, accompanied by the power, to put an end to them. Thus Russia took an opportunity to declare her intention to disregard the provisions of the Treaty of Paris so far as they referred to her right to keep a fleet in the Black Sea. International peace can only be put an end to by a formal declaration of war. The public peace is also a term applied to the attitude of the members of a community to each other; and in most countries, as in England, a breach of the peace is a punishable act, and may be dealt with by justices of the peace, who, indeed, are empowered to prevent an intended or expected breach of the peace by calling on the person suspected to provide security, or to enter into his own recognisances to preserve the peace, under pain of imprisonment in default. This process, which is called the "exhibition of Articles of Peace," may be entered upon by justices either upon complaint, or of their own motion. *Religious Peace* is the term applied to the convention which, after the Reformation, secured to the Protestant states of Germany the enjoyment of religious freedom. *Peace Society*, a society formed with the object of introducing the principle of arbitration as a substitute for war to settle disputes between nations.

Peace, CLERK OF, an officer whose duty it is to read indictments at the quarterly or other sessions of the peace, to enrol the Acts, draw the process, and perform various other duties connected with the administration of justice at the sessions.

Peach (*Amygdalus persica*), probably a native of China, where it has certainly been cultivated from the 5th century B.C., but introduced from Persia into Greece, probably by Alexander, a century later. It is commonly grafted on the plum or almond (q.v.). The *nectarine* is merely a smooth-fruited variety, differing, however, in flavour. The stone or endocarp in both is coarsely furrowed, and the leaves are conduplicate in the bud. The flowers, which appear before the leaves, are of a delicate pink. The fruit in the peach has a separable woolly

epicarp. Though deliciously flavoured and refreshing, since it contains 85 per cent. of water and 8 per cent. of pectose and gum, it does not contain much nutriment. Peaches grow luxuriantly in America, where they are employed in distilling a brandy and as food for pigs, and whence we import them either tinned or dried.

Peacock, any individual of the genus *Pavo*, Eastern Game Birds, with the bill of moderate length, the head crested, the wings rather short, the tail long, the upper coverts very long, and extending beyond the tail feathers. There are two species—*P. cristatus*, which has long been domesticated; and *P. muticus*, the Javan Peacock. Some authorities count a third (*P. nigripennis*), while others consider it a mere variety. The domestic peacock is a native of India, where it occurs in large flocks. Its splendid plumage is too well known to need description; but it should be noted that the “peacock feathers” used by the male in his display and by man for decorative purposes are those of the upper tail-coverts, not of the tail. In these feathers the webs are separate for the greater part of the length, but united at the end, where there is an eye-like spot. The colours are chiefly greenish-blue and gold, brilliantly iridescent. The female bird is smaller and less gorgeously feathered than the male, and carries no train. These birds are now kept chiefly for display, though the flesh was formerly held in high esteem.

Peacock, THOMAS LOVE (1785–1866), novelist, was the son of a London merchant. Although his learning was mainly self-acquired, he became one of the best classical scholars of his time. After publishing four volumes of poetry, he produced a novel, *Headlong Hall* (1815), which was followed by *Melincourt* (1817), *Nightmare Abbey* (1818), *Crotchet Castle* (1831), and others of the same type. Apart from the gay lyrics which appear here and there in the novels, Peacock's best poem was *Rhododaphne*, published in 1818. He became the intimate friend of Shelley.

Peacock Butterfly (*Vanessa io*), a widely-distributed and one of the most beautiful of English butterflies. There is a large “eye”-like mark on each of the four wings.

Pea-Nut. [GROUND-NUT.]

Pear (*Pyrus communis*), a tree belonging to the sub-order Pomaceæ of the Rosaceæ (q.v.), and to the same genus as the apple (q.v.). It grows from 30 to 70 feet high, with a pyramidal outline; branches spinous in the wild state; leaves scattered, stalked, ovate, and somewhat leathery; flowers in clusters of five to nine, white, with a goat-like smell; fruit turbinate, with a fleshily-enlarged stalk, core near the apex and parchment-like, and black seeds. Gritty particles, due to groups of wood-cells, occur in the flesh, especially of the wild form. The pear is native to Great Britain. Of the numerous cultivated sorts some are hard and tasteless when gathered, and require to be kept several months; others are only suited for stewing or baking. Perry, or fermented liquor

made from pears, is somewhat similar to cider. The flavour of the fruit is attributed to amyl acetate, an artificially-prepared alcoholic solution



PEARS.

of which is used in confectionery under the name of *essence of jargonelle pears*.

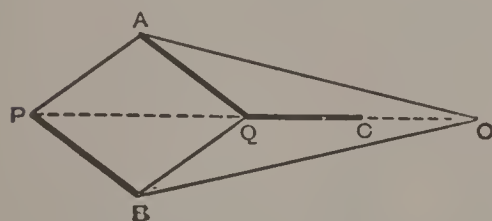
Pearl (Latin, *pirula*, “a pear, a jewel”), generally, as the name implies, pear-shaped, a mass of nacre, formed within the body or shell of certain molluscs—e.g. the Pearl-oyster, and the Unio, or freshwater mussel. The pearl-oyster, however, it may be remarked, is not an oyster. The received theory of the origin of pearls is that they are caused by the presence of a foreign body within the shell or body of the animal, such body in the course of nature being covered by an extra secretion of shell-forming substance, in much the same way that a bullet or other foreign body becomes encysted within the human frame. This fact is taken advantage of to produce artificial pearls by the introduction of particles of sand or the like into the shell of the pearl-bearing oyster. The pearl-oyster is chiefly found in the Persian Gulf, Japan, the Bay of Bengal, Ceylon, and other parts of the Indian Ocean. South American waters also have produced fine pearls. The ancients were well acquainted with the pearls of Ceylon and the Persian Gulf. The pearl-fisheries, which start in spring, employ many boats, the crews of which generally number twenty, ten of whom row, while the rest are divided into shifts of five who relieve each other in the work of diving for the oysters. The pearls, which differ according to the locality and food of the oyster, are polished with nacre-powder, are passed through sieves which separate them by size into mill-, vivadoc-, and seed-pearls. The most prized are those found in the soft parts, and are called virgin pearls. The nacre lining the shell, or *mother-of-pearl*, is also valuable, and is split from the shell and classed as silver-lipped, bastard-white, and bastard-black. The Ceylon fisheries—which are now under Government control—have fallen off considerably, whether from overfishing, or from the migration of the oyster, for this animal has the power of separating from its beard and taking up a new position. Among notable pearls may be mentioned

one possessed by Julius Cæsar worth £48,000, one by Cleopatra (£80,000), one by a Shah of Persia (£180,000), and a South American pearl of 250 carats (£150,000). Western Australia produces pearls and mother-of-pearl of considerable value. The pearl-mussel is found in most shallow rivers of Central and Western Europe.

Pearly Nautilus, the popular name for the true Nautilus (q.v.), used to distinguish it from the Paper Nautilus (*Argonauta*).

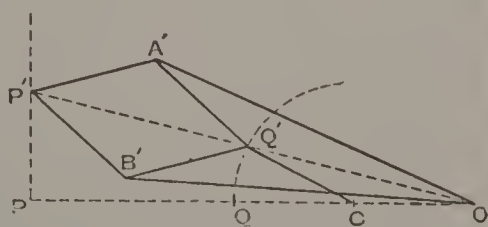
Peat, vegetable matter, more or less altered, accumulated to a depth sometimes reaching 50 feet in regions in temperate climates where there is insufficient drainage. It may be compact, but is generally fibrous and brown or black, and contains about 60 per cent. of carbon. The bogs in which it is formed are known as *peat-mosses*. They occupy one-seventh of the surface of Ireland and large areas in other countries, often covering the sites of lakes which they have choked, and entombing the stems of oak, yew, pine, and other woods, and the bodies of prehistoric mammals, preserved by its antiseptic power. It is mainly made up of the bog-moss (q.v.) *Sphagnum* in most districts; but in the English fens, of rushes and sedges. It forms at a rate of from half an inch to two and half inches per annum, and is largely dug under the name of *turf* for fuel in Ireland and elsewhere. When swollen by heavy rain, peat-mosses sometimes burst the layer of matted vegetation that covers them, especially if on an elevated ledge, and inundate the neighbourhood with black mud.

Peaucellier Cell is a seven-bar linkage invented in 1864 by a French officer, after whom it is named. The accompanying figure (Fig. 1) shows it in its simplest position. Four equal bars A P, A Q, Q B, B P are jointed to form a rhombus, the joints allowing it to be freely closed or opened. O A and O B are equal bars fixed at O, while C Q, the seventh bar, is half the length



PEAUCELLIER CELL (Fig. 1).

O Q, and is fixed at C. Q therefore is constrained to describe a circle whose radius is C Q, while A and B move in circles round O. If A' Q' B' P' (Fig. 2) be any new position of the rhombus or "cell," it is easy to show that the product $O Q' \times O P'$ is equal to $O A'^2 - Q' A'^2$; but $O A'$ and $Q' A'$ are fixed lengths; hence the product $O Q' \times O P'$ is constant for all positions of the linkage, and is therefore equal to $O Q \times O P$. From this it follows that P' P is perpendicular to O P. Hence while Q describes a circle, P moves in a straight line. P and Q are called the "poles" of the cell.



(Fig. 2)

The fixed point C may be anywhere on the line O P, and the point P will describe a circle, the radius of which depends upon the position of C; when, however, O Q is bisected at C, as in the case described, the radius becomes infinite, and so P describes a straight line.

Peba (*Tatusia novemcincta*), an armadillo (q.v.) ranging from Texas to Paraguay. It is about thirty inches long, of which the tail counts for nearly half. There may be seven or nine bands in the carapace; there is a pair of teats in the groin as well as on the breast, and from four to ten young are produced at a birth.

Peccary, either of the two species of *Dicotyles*, a genus of small wild swine from the New World.



PECCARY (*Dicotyles torquatus*).

D. torquatus ranges from Arkansas to Patagonia, while *D. labiatus* is confined to the country between British Honduras and Paraguay. The former is harmless, but the latter species is very fierce and roams about in large herds.

Pecock, REGINALD (circa 1390–1460), probably a Welshman by birth, was elected fellow of Oriel College, Oxford, in 1417. In 1444 he was appointed Bishop of St. Asaph, whence he was translated to Chichester in 1450. His *Represser of Overmuch Blaming of the Clergy* (1449) was a defence of the doctrines and ritual of the Church against the attacks of the Lollards. His views on the relation of natural and revealed religion and other points bear a striking resemblance to those of Hooker. In a later work, the *Treatise on Faith*, his position frequently approaches that of the Lollards themselves; thus he disputes the infallibility of the Church, and accepts probability as a ground of faith. In consequence of an attack on his writings made in a council at Westminster in 1457, he was cited before Archbishop Bourchier, and forced to recant. The intervention of the Pope, to whom he appealed, failed to avert the loss of his see, and his closing years were spent in retirement at Thorney, in Cambridgeshire.

Pecten, the type-genus of the Scollops or family *Pectinidae*. They are bivalve Mollusca, with generally ribbed shells, but always provided with a pair of "ears" to each valve of the shell. They commence in the Trias, after which they are abundant as fossils. The genus has often been

quoted from Palæozoic rocks, but these belong to other genera, such as *Aviculopecten*, *Pernopecten*, etc. Those scollops with smooth shells are often separated as the genus *Entolium*.

Pectinated Rhombs are certain rhombic areas on the plates of the Palæozoic (q.v.) class of Echinoderms known as Cystideæ; these areas are crossed by a number of grooves pierced by pores. Their function is uncertain; they may be respiratory, reproductive, or both.

Peculiar People, a religious sect founded in London in 1838, and also known by the name of FAITH-HEALERS. Their distinguishing feature is the following literally the apostolic injunction (James v. 14) in case of disease, and anointing the patients with oil, and praying over them, as a means of cure, in the place of calling in skilled medical assistance. The sect is not numerous.

Pedata, an order of Sea-cucumbers or Holothurians including those with well-developed tube feet (pedicels or pedia) which are the most typical forms. It is subdivided into two sub-orders: the Dendrochirota, in which the tentacles are arborescent, and the Aspidochirota, in which the tentacles are simple and peltate. The former is represented by the common British *Psolus*, and the latter by the type-genus *Holothuria* or cotton-spinner.

Pedia, or PEDICELS, are the "tube feet" of Sea-urchins, Starfish, and Brittle-stars; they are locomotive organs, and assist in respiration. It is important to distinguish them from the pedicellariæ, which occur in the same animals but are different both in function and structure.

Pedicellariæ are spines found in various classes of the Echinoderms, and so modified as to form prehensile organs. The typical forms occur on the Sea-urchins; these consist of a small flexible stalk, at the free end of which are three pointed valves; these are hinged and can be closed round any foreign body with which they come in contact. Their grip is often so firm that the head of the pedicellariæ is usually torn from the stalk before the valves are relaxed. In some cases, as in the Heart-urchin (*Spatangus*), the pedicellariæ is enclosed in a hollow in the plates of the external skeleton or test. In others there are four valves; while in some forms, known as "globuliferi," the valves are atrophied and only the gland and stalk remain. In the Starfish the pedicellariæ are usually sessile—i.e. have no stalk—the valves are rarely more than two in number, and are pointed instead of hooked. In the common English Brittle-stars pedicellariæ are quite absent, but in some tropical species belonging to the Euryalida there are some simple forms which are probably rudimentary. The function of the pedicellariæ is very doubtful, and probably differs in the different classes; they are unquestionably prehensile organisms and help in locomotion, seizing food, removing excreta, or may also be organs of touch and smell.

Pediculidæ. [LICE.]

Pediculus. Three species of lice are met with in the human subject—the *Pediculus capitis* or head-louse, the *Pediculus corporis* or body-louse, and the *Pediculus pubis*. The first-named variety sometimes infests the heads of children, causing much irritation. The female louse deposits the ova or nits upon the hairs, where they are seen as minute semi-transparent bodies. The body-louse deposits its ova on the clothes, and its presence brings about a papular eruption on the skin. The condition in which the body is infested by lice is called phthiriasis. Treatment consists in the abundant use of soap and water, with employment of such applications as mercurial ointments or a preparation of staphisagria seeds.

Pedipalpi, an order of air-breathing Arachnida (q.v.) closely allied to the Scorpions, which used to be included in it. The members of this order differ from the Scorpions in that the head and thorax are fused into a mass and separated from the abdomen by a definite constriction. They thus in some ways resemble the Spiders. They further differ from the Scorpions by having no sting on the end of the abdomen. They differ from the Spiders by the presence of a jointed abdomen and the absence of the web-spinning organ or spinnerets. The two principal genera are *Thelyphonus*, which has the "pedipalpi" or "foot-palps," chelate or pincer-like; and *Phrynus*, in which they are only clawed. Both are land-dwellers, and live in tropical regions.

Pedometer, in its simplest form, is an instrument used for measuring the number of paces taken by a pedestrian. It is generally of the shape and size of a watch, and is carried in the pocket, a movable lever or pendulum moving at each pace taken and recording the same by means of a needle which traverses a certain marked space on the dial. Modifications of this instrument attached to a wheel will register the number of revolutions made, and a similar contrivance is used to register the revolutions of the screw or paddle-wheels of steam vessels.

Pedro the Cruel (1334-69), King of Castile and Leon, was the son of Alfonso XI., whom he succeeded in 1350. He received his surname in consequence of the murder of his brother, Don Fadrique (1358), who had joined the fallen minister, Albuquerque, and another brother, Don Enrique, in stirring up a revolution. Enrique fled to France, but returned in 1366 with an army composed of free companies, led by Bertrand du Guesclin and Calverley. Pedro then secured the aid of Edward the Black Prince, by whose forces Enrique was defeated in the battle of Najera or Navarrete (April, 1367); but he failed to fulfil his promises to the prince, and alienated him by his haughty conduct. Edward, therefore, returned to France, and in 1369 Pedro was vanquished by Enrique at Montiel. A few days later he was inveigled into visiting his brother in his tent, and there a quarrel broke out, in which Pedro was slain.

Pedro I., EMPEROR OF BRAZIL (1798-1834), was the son of John VI. of Portugal, whom he accompanied to South America when he fled

thither during Napoleon's invasion (1807). On his father's return (1821), he remained behind as regent, and in the following year was declared emperor, Brazil becoming an independent state. The constant anarchy which prevailed culminated in a revolution (1831), and Dom Pedro abdicated in favour of his son, and sailed to Europe, where he passed the remainder of his life.

Pedro II., DE ALCANTARA (1825-91), was declared emperor in 1831. After a long and peaceful reign, during which he did much for the development of his country, a sudden revolution forced him to leave Brazil for Europe (1889). He then took up his abode in France. He was a man of no little scientific attainment.

Peduncle (from the Low Latin *pedunculus*, "a little foot"), the axis, or *foot-stalk*, as it is sometimes called, bearing an inflorescence. Its branches, if any, are called *secondary peduncles*, or, if they are the ultimate ones bearing the flowers, *pedicels*. The tulip has an unbranched peduncle; in the fig (q.v.) it becomes fleshily enlarged and, by peripheral growth, concave, bearing the flowers within its cavity. In many plants it bears leaves below the flowers, known as *bracts* (q.v.), or, when collected together, as the *involucre* (q.v.); and in the Cupuliferæ (q.v.) it gives off a cup-shaped outgrowth which contributes to the formation of the cupule. [RECEPTACLE.]

Peduncle, the stalk by which various animals are attached, as in the Barnacles or Brachiopoda. [LAMP SHELLS.]

Peeblesshire, or TWEEDDALE, a county in the south of Scotland, bounded N. and N.E. by Edinburghshire, E. and S.E. by Selkirkshire, S. by Dumfriesshire, and W. by Lanarkshire. The maximum length from N. to S. is 29 miles, the breadth 21 miles, and the area 356 square miles. The central part of the country is occupied by the narrow valley of the Tweed, on each side of which is an upland tract, consisting for the most part of massive grassy hills or mountains, generally rounded in form, such as Broad Law and Cramalt Craig, both over 2,700 feet, intersected by rich valleys and deep gorges. Much of the surface is occupied by large sheep-farms. Peeblesshire and Selkirkshire are together represented in Parliament by a single member. Peebles, the county town, is situated at the confluence of Eddlestone Water and the Tweed, 22 miles S. of Edinburgh. It has been a royal burgh since 1367. The Chambers Institution (1859) was the gift of the well-known publisher, William Chambers (1800-83), who was a native. A large hydropathic establishment was opened near the town in 1881. Woollen goods are manufactured here and in the neighbouring town of Innerleithen.

Peel, SIR ROBERT (1788-1850), statesman, born near Bury, in Lancashire, was the son of Sir Robert Peel, Bart., a wealthy cotton manufacturer. He was educated at Harrow and Christ Church, Oxford. In 1809 he was elected Tory member for Cashel, and in 1811 was made Under-Secretary for the Colonies. As Chief Secretary for Ireland (1812-18) he aroused

so much ill-feeling by his ultra-Protestant policy that he was at length compelled to resign. Meanwhile he had exchanged his former seat for that of Oxford University. In 1819 he was chosen Chairman of the Bank Committee, and in this capacity effected a return to cash payments. His tenure of the office of Home Secretary under Lord Liverpool (1822-27) was marked by many useful measures. Being unable to agree with Canning, who succeeded Lord Liverpool as premier, on the question of Catholic Emancipation, he resigned; but in 1828 he joined the Duke of Wellington in forming a new Cabinet, in which he again took charge of the Home department. At the same time he became leader of the House of Commons, and found himself forced to move the Catholic Relief Bill (March, 1829), the very measure which had occasioned his withdrawal so short a time before. This change of policy led to his defeat at Oxford, and ultimately to the overthrow of the Government (November, 1830). For the next ten years he was leader of the Opposition, with the exception of an interval in 1833-34, during which he led a Conservative Ministry, which speedily found itself too weak to combat the Whigs. His attitude in regard to the reforming policy of the Melbourne Administration was marked throughout by moderation, good sense, and great practical ability. He was hailed with enthusiasm as leader of the Tory party on its return to power in 1841, but such measures as the Maynooth grant and the establishment of the "godless" colleges in Ireland, no less than the Premier's financial policy, which was evidently in the direction of Free Trade, caused a rift in the Conservative party which resulted ultimately in its collapse. The climax came with the proposal to repeal the Corn Laws (q.v.), which Peel—already a Free-Trader at heart—felt to be forced on him by the Irish famine and the bad harvest in England in 1845. Deserted by an important section of his followers, he retired to make way for Lord John Russell; but the latter failed to form a ministry, so that it actually fell to Peel to carry through the House the Bill for the complete abolition of all duties on corn. In July, 1846, he was defeated on an Irish Coercion Bill through a combination of the Whigs and the dissatisfied Tories. During the rest of his life he gave an independent support to the Whigs as far as their home government was concerned, though he opposed their foreign policy. He died in 1850.

Peele, GEORGE (c. 1558-98), dramatist, was the son of James Peele, Clerk of Christ's Hospital. He was a student of Christ Church, Oxford, from 1574 to 1579, taking his master's degree in the latter year. Already a noted poet at the university, he now proceeded to London, and in 1584 published *The Arraignment of Paris*—a pastoral comedy, interspersed with songs—which was written for representation before the queen. Its highest merits are ready wit, ingenious fancy, and elegant versification—qualities which may also be claimed for *Edward I.* (1593), *The Old Wives' Tale* (1595), and *David and Bethsabe* (1599), although a tendency to bombast is always apparent. In London Peele led a wild, dissipated life, and seems to have been

often reduced to extreme poverty. He died of a disease brought on by his vicious habits in 1598.

Peewit. [LAPWING.]

Pegasus, the winged horse of mythology, was the offspring of Poseidon and Medusa, springing from the latter's body when her head was cut off by Perseus. Bellerophon rode upon him to his encounter with Chimera, and then attempted to fly to Heaven, but was thrown by Pegasus, whom a gadfly stung. With a stroke of his hoof Pegasus gave rise to the spring Hippocrene in Mount Helicon. He is said to have been fixed in the heavens as a constellation.

Pehlevi, a form of the Persian language formerly current in western Iran, intermediate between the Old Persian of the Behistun inscriptions and Modern Persian, but overcharged with Semitic elements; is the language of the coins of the Sassanian dynasty, of several inscriptions of the early Sassanian kings, and of the oldest extant comments on the Avesta; died out towards the middle of the seventh century; grammar, by Spiegel, who proposes *Huzvares* as the proper name of this mixed Perso-Semitic language. The alphabet, of which there are several forms, is derived from the Aramaic or Old Syriac (Estranghelo), which is itself derived from the Phœnician.

Peine Forte et Dure—"stern and bitter penalty"—was a method of compulsion inflicted upon those who refused to plead when indicted for felony. In cases of high treason, or petty larceny, such a refusal was treated as equivalent to a confession of guilt. The practice existed in the time of Edward I., and was finally abolished by 12 George III., and refusal to plead now amounts to a plea of "Not Guilty." The sufferer from it—who might, however, plead benefit of clergy—was taken back to prison, laid on his back, subjected to a gradually-increasing weight of stone or iron, and fed on alternate days with mouldy bread and a draught taken from the standing water nearest the prison, the process continuing till he pleaded or died. His object in resisting was, of course, to escape the injury his conviction would have entailed on his family by confiscation of his property, etc.

Pekan. [MARTEN.]

Peking ("Northern Capital"), the capital of the Chinese Empire, is situated at the head of a sandy, alluvial plain, 700 miles in length, in lat. 39° 54' 36" N., and long. 116° 27' E. It comprises an inner or "Tatar" city, which is square in form, and an oblong outer or "Chinese" city, which adjoins the former on its S. side, extending somewhat farther towards the E. and W., but considerably narrower from N. to S. Both cities are surrounded by walls, those of the inner city being about 50 ft. high, and from 40 ft. to 60 ft. thick. Their total length, excluding the cross wall, is 21 miles, and they embrace an area of nearly 26 square miles. There are sixteen forts, each of which is surmounted by a lofty tower built in

galleries with numerous loopholes. The Tatar city is divided into three quarters, the outermost portion, which covers the larger part of the area, enclosing the quadrangular "Imperial City," within which, again, is the "Purple Forbidden City," also oblong in form, with a circuit of somewhat over two miles. To this inmost city foreigners are not admitted. Besides the palaces of the emperor, his kinsfolk, and various high officials, it contains several spacious and magnificent public halls, such as the Hall of Grand Harmony, in which the emperor holds his *levées*. The "Imperial City" is surrounded by a wall of 20 feet, the western portion consisting of the "Western Park." To the N. of the "Purple Forbidden City," on the other side of a moat, is the wooded artificial mound called "Prospect Hill," 150 feet in height. In the outside quarter of the inner city, to the N. of the Imperial City, are the Drum and Bell Towers. The outer or Chinese City contains but few buildings, the greater part of the surface consisting of wooded or cultivated ground, with numerous artificial lakes and tanks. Here is the famous Altar to Heaven, the most celebrated of the many religious spots in Peking. Unlike most Chinese towns, Peking has spacious streets, the width of the more important thoroughfares exceeding 100 feet in the outer city, while in the inner city it is even more. These streets are lined with brick buildings of one storey, the shops being decorated with gilding and paint, so as to present a bright and attractive appearance. Elsewhere in Peking, however, the houses are wretched hovels. There is now a Roman Catholic cathedral, and an imperial university with European professors was established in 1868. The climate is very severe, varying from 10° in winter to 105° in summer. There are but few manufactures, and little trade of any kind. Peking is a city of great antiquity, its history dating back to the 12th century B.C., when it was the capital of the province of Yen.

Pelagius, or MORGAN (*circa* 380-450 A.D.), the founder of the heresy which bears his name, was a native either of Britain or Brittany—more probably the former. He lived for many years in Rome, but crossed over to Carthage with his devoted follower Coelestius after the sack of the city by Alaric in 410. Coelestius having attempted to obtain orders, his views were called in question and condemned in a Carthaginian synod. When these tidings were carried to Jerusalem, where Pelagius then was, a charge of heresy was brought against him by Orosius, who was supported by Jerome. These efforts to discredit his teaching were at first unsuccessful, but Popes Innocent I. and Zosimus declared against him, and he and his followers were finally condemned in a council at Carthage attended by 214 bishops (418). He was soon afterwards banished from Rome. The most formidable opponent of Pelagianism was St. Augustine, Bishop of Hippo, who wrote several treatises against it. Portions of Pelagius' own works remain, including a *Commentary on St. Paul's Epistles*. The substance of his heresy was a denial of original sin.

Pelargomorphæ, in Huxley's classification, a group of birds containing the storks and their allies.

Pelargonium, a large genus of Geraniaceæ, mostly natives of South Africa, varying in habit, some being succulent undershrubs. Many of them are cultivated in our gardens, under the name of Geraniums, for their showy flowers, which differ from the true Geranium (q.v.) in being monosymmetric, having a spur to the posterior sepal adherent to the pedicel, the petals sometimes differing in shape and colouring, and from three to six of the ten stamens are abortive. The leaves are stipulate, palmately-veined, and entire or lobed; the flowers are in a simple umbel with an involucre; and the styles, which adhere to a columnar carpophore in the beak-like fruit, twist spirally when it is ripe. The name means stork's-bill. *P. capitatum* is cultivated round the Mediterranean for the essential oil of geranium used to adulterate attar of roses (q.v.); but it is now chiefly obtained from the Indian grass *Andropogon Schænanthus*.

Pelasgians, the oldest known inhabitants of Greece, who are supposed to take their name from Pelasgus, youngest son of Niobe, and who are traditionally represented as a wandering people who left traces of their presence in every part of Hellas (*Pelasgiotis*, a district of Thessaly; the *Pelasgieum* or oldest parts of the Acropolis of Athens, built by them, etc.). Regarding their origin and ethnical relations to the Greeks proper much diversity of opinion prevails; but although Herodotus distinguishes between them and the true Hellenes, and speaks of Pelasgian dialects still surviving in his time at Creston, in Thrace, and at Placia, in the Hellespont (I. 57), Dionysius is probably right in regarding the Pelasgians as essentially Greeks (*to tôn Pelasgôn genos Hellenikon*). It may, in fact, be inferred from Thucydides (I. introduction) that they represent the first waves of Hellenic migration into Greece and the islands, where they continued to lead wandering lives as pirates and rovers on the sea and marauders on the mainland before forming settled communities. According to this view, which seems most in accord with the national traditions, the Pelasgian dialects mentioned by Herodotus would represent an archaic form of Greek before it became differentiated into the later Æolic, Doric, and Ionic dialects.

Pelasgic Architecture, the earliest type of masonry found in Greece. It consists of masonry constructed, without cement, of unhewn stones.

Pelecypoda, a term meaning "axe-footed," now often used as a substitute for Lamellibranchiata (q.v.), the bivalve shell-fish. The foot in this class is usually triangular and somewhat axe-like.

Pelham, THE FAMILY OF, has produced several distinguished English statesmen. THOMAS HOLLES PELHAM, Duke of Newcastle (1693-1768), was the son of Thomas, first Lord Pelham, and Lady Grace Holles, daughter of Gilbert Holles, third Earl of Clare. He attached himself to the

Whigs, and in 1716 was created Duke of Newcastle. After acting as Secretary of State under Walpole from 1724 to 1738, he began to intrigue against him, encouraging the king's wish for war, and procuring Walpole's downfall in 1742. From 1743 to 1754 he was Secretary of State in the ministry of his brother Henry Pelham, whom he succeeded as First Lord of the Treasury. In 1756 his unpopularity compelled him to resign, but he returned to office in the following year as nominal head of a ministry, the real leader of which was Pitt. In 1762 he retired to make way for Bute. He was afterwards Lord Privy Seal in the short Rockingham Administration of 1765. Newcastle possessed no political gifts of a high order; his long tenure of power was wholly due to his wonderful tact and adroitness in intrigue. His brother, HENRY PELHAM (1696-1754), became Secretary of State for War in 1724, and Paymaster of the Forces in 1730. After Wilmington's death in 1743 he became head of a ministry as First Lord of the Treasury and Chancellor of the Exchequer, and, except for a short interval in 1744, remained in power till his death. His ministry, which at first included Carteret and afterwards Pitt and Chesterfield, earned the name of the "Broad Bottom Administration." The War of the Austrian Succession was brought to a close by the Treaty of Aix-la-Chapelle in 1748. Of other measures of the ministry the most important were those connected with the Jacobite rising (1745), Pelham's successful financial bill lowering the interest of the national debt to three per cent. (1750), the reform of the calendar, and Lord Hardwicke's Marriage Act (1753). Pelham was a skilful financier, and his policy was highly advantageous to British trade. HENRY PELHAM-CLINTON (1811-64), fifth Duke of Newcastle, entered Parliament in 1832, and attached himself to the party of Sir Robert Peel. He was Secretary of State for War during the early part of the Crimean War, and endeavoured to secure an efficient management of the department, but resigned in consequence of the feeling excited against him by the hardships of the troops (1855). He was subsequently Colonial Secretary (1859-64).

Pelican, any bird of the genus *Pelecanus*, constituting the family *Pelecanidæ*, with several species, from tropical and temperate regions. Pelicans are large fish-eating water-birds, frequenting rivers, lakes, and coasts, and rarely seen far from land. They have a long, large, flattened bill; the upper mandible is strongly hooked, and beneath the lower is a large dilatable pouch of naked skin, serving as a receptacle for prey, which is stored therein, either to feed their young, or to be devoured at leisure. The best known species, the Common Pelican (*P. onocrotalus*), is a native of south-eastern Europe, Asia, and North Africa. It is about the size of a swan, but looks larger, from the fact that the plumage is very loose. The general hue is white, with a flesh tint, and in old birds the feathers on the breast become of a golden yellow. The nest, with two or three white eggs, is usually on the ground, not far from water. The story that the mother-bird feeds her young with

blood from her own breast is, of course, fabulous ; but as flamingoes discharge a bloody secretion into the mouths of their young, and even into the



PELICANS (*Pelecanus onocrotalus*)

mouths of other birds, it has been suggested that this habit, transferred from one bird to another, and added to in the process, is the foundation of the myth.

Pelican-Fish, a deep-sea eel-like fish, with large head and exceedingly wide gape, described in 1882. In the following year *Gastrotomus bairdii*, of somewhat similar structure, was discovered. These are probably allied to the genus *Saccopharynx*, deep-sea eels, remarkable for swallowing fish larger than themselves.

Pelion, in classical geography, was a lofty mountain-ridge of Thessaly, extending along the sea-coast throughout the whole length of Magnesia from Mount Ossa on the north to the promontories of Sepias and Æantium on the south. It is still covered with vast forests, as it was in the days of Homer. An ancient myth tells how the Titans piled Ossa on Pelion in their endeavour to scale Olympus.

Pélissier, JEAN JACQUES AMABLE (1794-1864), Duc de Malakhoff and Marshal of France, was born at Maromme, in the department of Seine-Inférieure. He began as a private soldier, and from 1839 to 1855 he was engaged in active service in Algeria, becoming General of Division in 1850 ; he cruelly suffocated 500 Arabs in a cave (1845). In May, 1855, he succeeded Canrobert as commander-in-chief of the French forces in the Crimea, and on the fall of Sebastopol was created Duc de Malakhoff. In 1860 he was appointed Governor-General of Algeria.

Pellagra, a disease met with in Italy and the south of Europe, one of the characteristic symptoms of which is a skin eruption of an erythematous type, accompanied by much itching, and leading to the deposit of cutaneous pigment.

Pellev, EDWARD, VISCOUNT EXMOUTH (1757-1833), entered the navy early, and became a captain in 1780. He was knighted in 1793, and three years later made a baronet for his bravery. In 1814, when admiral of the Blue, he was created Baron Exmouth, being finally made Viscount in 1816 for his services at Algiers.

Pellico, SILVIO (1788-1854), Italian patriot and man of letters, was born at Saluzzo, in Piedmont. During his residence at Milan (1810-20) he published several tragedies, which are now forgotten. His efforts to undermine the authority of the Austrians by means of his contributions to the *Conciliatore*, as well as his personal influence, led to his arrest in 1820. He was eventually confined in the Spielberg at Brünn (1823) under a sentence of fifteen years' imprisonment ; but in 1830 he was released. *Le Mie Prigioni* (1832), an account of his life in prison, soon became popular throughout Europe, owing to the genuine tone of the narrative and the simplicity and grace of the style.

Pelmatazoa, the stalked members of the phylum Echinodermata—viz. the Sea-lilies—and the two extinct classes, the Cystoidea and Blastoidea. It is doubtful whether the classification will stand, as it is probable that many of the Sea-lilies or Crinoids, as well as some Blastoids, were stalkless. The common Rosy Feather Star of the English coasts (*Antedon bifida*, Linn.) is free in the adult form, but this is due to the loss of the stalk, which is present in the embryo ; but it is possible that some Crinoids, such as the remarkable genus *Marsupites* found in the Chalk, were absolutely stalkless.

Pelopidas (d. 364 B.C.), a Theban general and patriot, of noble birth, whose name is inseparably linked with that of his life-long friend and associate Epaminondas (q.v.). After the occupation of the Theban citadel by the Spartans (382 B.C.), Pelopidas, as a member of the democratic party, was forced to withdraw to Athens. In 379 he returned with his fellow-exiles, and expelled the Lacedæmonian garrison from Thebes. He was then elected one of the three *Bæotarchs*, or chief magistrates of the Thebans, and continued throughout the remainder of his life to hold high offices of state. As leader of the "sacred band," a chosen troop trained by himself, he played a conspicuous part in many brilliant victories over the Spartans. In 367 he undertook a successful embassy to the Persian monarch. He was slain at the battle of Cynoscephalæ, in which his troops were victorious over the Thessalian tyrant, Alexander of Pheræ.

Peloponnesus, the ancient name of the Morea, the peninsula which forms the S. part of Greece. Its area is about 9,000 square miles. The leading Peloponnesian states were Sparta (q.v.), Corinth (q.v.), and Argos.

Pelops, a hero of Greek mythology, the son of Tantalus and grandson of Zeus. The myth relates that Tantalus slew his son, and served him up at a banquet to the gods ; but the only part eaten was part of a shoulder which Demeter took in absence of mind. The gods then restored Pelops to life by placing the limbs in a boiling caldron, the place of the lost shoulder being supplied by one of ivory.

Pel's Fish Owl. [FISH-OWL.]

Peltier Effect. Lubeck discovered in 1822 that an electric current might be produced by heating or cooling the junction of two dissimilar

metals in a closed circuit, and so it was to be expected that when a current is sent from a battery, or some other source, across such a junction that point would be heated or cooled. The actual phenomenon was discovered by Peltier in 1834. If, for instance, a current be sent along a wire one-half of which is of antimony and the other half of bismuth, the junction of those two metals will be heated if the current flow from the antimony to the bismuth; but the junction will be cooled if the current be reversed. This heating or cooling is known as the Peltier effect, and is proportional to the strength of the current causing it. It is to be distinguished from the heat developed in a circuit on account of its resistance, which is proportional to the square of the current and is not reversible, while the Peltier effect is reversible.

Pelvis. This term, derived from a Latin word signifying "a basin," is applied to that portion of the human skeleton which intervenes between the lumbar vertebræ and the thigh-bones. The pelvis is made up by the *sacrum* and *coccyx* posteriorly, while on each side are what are termed the *innominate bones*. Each innominate bone consists of three parts—the *ilium* above, the *ischium* below and behind, and the *pubes* anteriorly. The two pubic portions of the innominate bones are united in front, forming what is known as the *symphysis pubis*. The two iliac portions of the innominate bones articulate with the lateral aspects of the sacrum, forming the *sacro-iliac* joints. The three portions of the *os innominatum* are fused in the adult, but are distinct bony masses in early life; they meet together at the *acetabulum*, the cup-like cavity with which the head of the femur articulates. Just below and in front of this cavity there is a large opening in the *os innominatum*, which is called the *obturator foramen*. The pelvis is divided into two parts—the true and the false pelvis; these are separated from one another by a plane which is called the *brim* of the true pelvis. This brim is mapped out by the promontory of the sacrum behind, and by two ridges which extend on each side from the sacral promontory to the anterior portion of the pubes, and are known as the *ilio-pectineal* lines. [KIDNEY.]

Pembrokeshire, the most westerly county of South Wales, is open to the sea on all sides except the E., where it adjoins Cardiganshire and Carmarthenshire. The coast-line is for the most part rugged and deeply-indented, the chief inlets being Milford Haven (q.v.), St. Bride's Bay, Newport Bay, and Fishguard Bay. The surface consists of ranges of green hills, separated by fertile valleys. The quality of the soil varies greatly in different localities. Coal, slate, iron, and lead are worked. Many of the people in the neighbourhood of Haverfordwest are descended from a colony of Flemings which settled here in the reign of Henry I. The name "Little England beyond Wales" has been given to the county, owing to the exceptionally large proportion of English-speaking inhabitants. The county sends one member to Parliament, and contains three municipal boroughs—Pembroke, Haverfordwest, and Tenby. PEMBROKE, the county

town, is situated on a navigable creek of Milford Haven, $9\frac{1}{2}$ miles west of Tenby. It is famous for its castle, the birthplace of Henry VII., which was erected towards the close of the 11th century. There is a fine keep, 75 feet in height, and the walls are 14 feet thick. The Government dockyard (1814), covering 80 acres, and strongly fortified, is situated at Pater or Pembroke Dock, $2\frac{1}{2}$ miles N.W.

Pemmican, a preparation of dried meat, used in North America, and resembling the *tasajo* of South America and the *biltong* of South Africa. The pemmican of North America is prepared by drying strips of lean meat in the sun and wind. This meat is then pounded and put into bags (fruits and berries being occasionally added), and then melted fat is poured into the bags. The preparation of pemmican for Arctic expeditions, in which it is found very useful, differs in some particulars from the above process, but the foundation is the same.

Pemphigus, a skin disease attended with formation of bullæ or blebs containing serous fluid.

Pen, an instrument for writing with fluid, has been known from remote antiquity. The earliest pens were perhaps of the nature of brushes for painting words or word-signs, but the reed-pen seems to have been early introduced, and a natural development seems to have been the employment of feathers from the wings of birds, which were so eminently fitted for this use, and which, in spite of later inventions, have never been surpassed. Quills are known to have been used in the fifth century A.D., and from that time the quills of geese, swans, turkeys, crows, ptarmigan, and other birds have been largely employed, and have given their name to the whole class of writing implements, since pen = *penna*, "a feather." In 1803 a steel-barrel pen was introduced, and it sold at half-a-crown. In 1830 the names of Perry, Gillott, and Mason came into prominence, and from that time the manufacture and improvement of steel pens has been steady. The great home of the pen manufacture is Birmingham. Gold is also employed for pens, the points being tipped for hardness' sake with an alloy of iridium. To avoid the trouble of carrying about a supply of ink separate from the pen, various kinds of fountain-pens, with an automatic ink supply, have been invented. The stylograph substitutes a movable needle for the ordinary pen, pressure on the needle enabling the ink to flow through a small orifice, and mark the surface to be written upon.

Penance, a punishment for fault or sin, self-inflicted or voluntarily submitted to. Most religions of the world have encouraged the idea that voluntary suffering expiates some of the effects of sin, among such religions being notably the Jewish, the Hindu, and the Christian. In the early Christian Church penance might be private, as a sequel to confession; public, in which the punishment, if not the confession, was in the presence of the congregation, and solemn, in which case the penitent was barred, for a longer or shorter time, from greater or lesser church privileges. Solemn penance

lasted in the Eastern Church till the fourth century, and in the Western till the seventh, its place being then taken by pilgrimages and the like. In the Roman Church penance is a sacrament, and consists of three parts—contrition, confession, and satisfaction, which are followed by absolution. Some Protestant bodies have endeavoured to reintroduce the ancient practice of public penance.

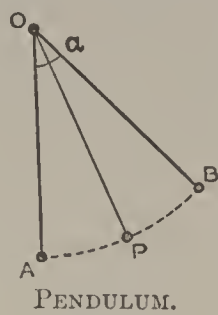
Penang, more fully PULO-PENANG ("Island of betel-nut palm"), also called PRINCE OF WALES ISLAND, the most northerly of the Strait Settlements, is situated on the Strait of Malacca, 360 miles N.W. of Singapore. It is separated from the Malay Peninsula by a channel which varies in width from two to ten miles. The island is fifteen miles long, with an average breadth of eight miles, and an area of 106 square miles. It has belonged to England since 1785, and together with Province Wellesley on the opposite coast, which was annexed in 1798, forms a Crown colony. The surface is rugged and mountainous, rising to the height of 2,920 feet above the sea-level; but along the coast there is a low alluvial tract, the soil of which is very fertile. The whole island is well wooded, and rice, maize, sugar, and spices are largely cultivated. The temperature generally varies from about 70° to 95°. The capital, George Town, is a fortified place at the N.E. extremity of the island. About one-half the population are Chinese. Most of the commerce of the Malay Peninsula passes through Penang.

Penates. [LARES.]

Pencils (Lat. *penicillus*, "a little tail"), are of unfathomable antiquity, dating from the first pre-historic man who traced a figure in the sand or scratched a likeness on a bone. The descent has been gradual, from the metal graver with which steel or stone was marked, or the characters impressed on Assyrian clay, through the stylus of the Roman, used upon wax tablets, to the latest invented patent pencil. The natives of China and Japan still employ brushes for painting their letters. Sticks of coloured earths or chalks, now generally known as crayons, probably preceded the pencil as we now know it. The best graphite for the making of pencils comes from Siberia and other parts of Russia, and an inferior quality is found in Austria, Prussia, Ceylon, and North America.

Pendulum is a body of any shape which oscillates about a fixed point or axis under the action of gravity. A *simple* pendulum is only a scientific conception and cannot practically exist, although we can obtain an arrangement which approaches very nearly to the ideal. Theoretically, it consists of a heavy particle suspended by a perfectly flexible weightless string. If an impulse be given to it in one direction only, the heavy point will move to and fro along the arc of a circle, oscillating on either side of its lowest point and its position of equilibrium. Let A represent the particle at its lowest point and B at its highest, the string being fixed at the point O. If the angle A O B be large, then it is a mathematical problem of some complexity to determine the motion of that particle. In the special case, however, when its

velocity at A is just sufficient to take it round into a position vertically above O, we can obtain the curious result that it would take an infinite time to get there—that is, it would never reach the end of its journey. It is more profitable to consider the case



when A O B is so small that its sine and circular measure are equal, when the whole problem is greatly simplified. The speed at which the particle moves reaches a maximum at A and is zero at B. Suppose the particle has been allowed to fall from the point B (A O B being small), and to have reached a point P (Fig 1).

Let A O B = α and A O P = θ , then it is possible to deduce the equation $\theta = \alpha \cos. \frac{g}{l} t$, where t is the time which has elapsed since the particle left B, l is the length O A of the pendulum, and g is the acceleration due to gravity. α is called the *amplitude* of the swing, and a complete oscillation is two swings or a "swing-swang." The *period* is the time of a complete oscillation—that is, the time which elapses while the particle travels away from any point in its path and back again to the same point, its velocity in each case being in the same direction. A "complete oscillation" is sometimes referred to as a "double oscillation," and a swing is sometimes known as a "single oscillation." The period (T) can be at once obtained from the above equation by putting $t + T$ instead of t , since nothing else has changed. Then we find that

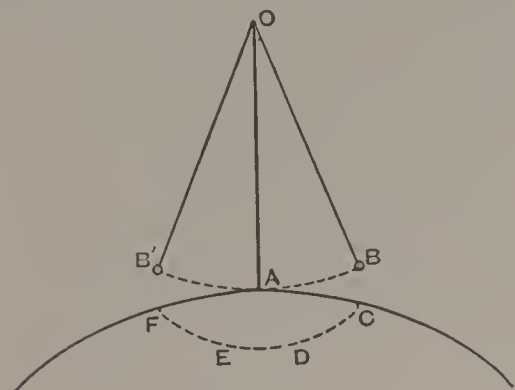
$$T = 2\pi \sqrt{\frac{l}{g}}.$$

At any spot on the earth's surface, then, the period of oscillation varies as the square-root of the length of the pendulum. A pendulum whose length is 4 inches will take twice as long to vibrate as one of 1 inch, while a particle at the end of a 9-inch string will take three times as long. By taking a pendulum of given length and measuring its period at different points on the earth, the relative values of g —the attraction of the earth—can be found for those points. Experimentally, the length of the *seconds* pendulum (one which takes two seconds for a complete oscillation) can be found; this for London is 39.1393 inches, and from this value the above equation gives $g = 32.19$ foot-second units. In this way it has been found how far the figure of the earth differs from a true sphere, the value of g being greatest where the earth bulges most. So also by comparing the rates of vibration of a pendulum at the surface and in the depths of a coal-mine it is possible to determine the average density of the earth.



In the case we have been considering, although the angle α is small, it can, of course, vary within certain limits, and it is then found that, whether we start the pendulum by letting it fall from B or some other point, E, the time taken for it to

get to A, is the same. Hence the period is the same. This fact—that the period is independent of the amplitude of swing—is known as the isochronism of the pendulum, and although



PENDULUM.—Fig. 3.

only true in this case for small amplitudes, is true entirely when the particle A is constrained to move in a cycloidal curve instead of a circle. In that case we may allow the particle to start from a point level with O, and it will take no longer to reach A than if we started it a few degrees away. It is this property of isochronism which gives the pendulum its immense value. Another very curious property was discovered by Foucault; this is that its plane of vibration appears to turn in the opposite way to the direction in which the earth rotates on its axis. The fact is that the pendulum, if set accurately moving in a straight line, maintains that direction absolutely in space, while the earth moves beneath it. The easiest case to consider is that of a pendulum swinging at the north pole, A (Fig. 3). It will swing in the same vertical plane, but gradually the points F C D E will pass beneath it. In 24 hours one complete revolution will have been accomplished, and the pendulum will be swinging over the same points as at first. In any other latitude the rotation of the earth can be resolved into two components—one about a vertical and the other about a horizontal axis. If the latitude be λ , then the vertical component of the rotation is proportional to $\sin \lambda$, and since it is only this vertical component which has any effect, the time taken for a pendulum to complete its cycle of apparent changes in direction is $\frac{24 \text{ hours}}{\sin \lambda}$. At the

pole, $\lambda = 90^\circ$, so the above expression becomes 24 hours. At the equator λ and $\sin \lambda = 0$, so that it takes an infinite time for the pendulum to change its apparent plane—i.e. it does *not* change. If, then, we lived far down in the earth and could not see the apparent motions of the heavenly bodies, Foucault's pendulum would give us proof of the earth's rotation.

Although a simple pendulum was stated to be an ideal conception, yet a compound pendulum vibrates according to the same laws. In fact, we can calculate from the dimensions of a compound pendulum what would be the length of the simple equivalent pendulum—i.e. one that vibrates in the same time. The period of oscillation through a small angle for a compound pendulum is found to be

$$T = 2 \pi \sqrt{\frac{k^2}{h g}}$$

where k is the radius of gyration (q.v.) of the compound pendulum about S, the *centre of suspension* (Fig. 4), and h is the distance between S and G, the centre of gravity. The length of the simple equivalent pendulum is, therefore, $l = \frac{k^2}{h}$. If we find the

point O on the line S G in our compound pendulum such that $S O = l$, this point O is called the *centre of oscillation* of the pendulum, and the points S and O are interchangeable—that is, if either be made the centre of suspension the other becomes the centre of oscillation, the period of vibration remaining the same in each case. It is upon this fact that the utility of Kater's pendulum (q.v.) depends.

Since the rate of oscillation depends upon the length of a pendulum, and since the length of any material is altered by heat, it follows that a pendulum of a clock would vibrate faster in the winter, when it is coldest and therefore shortest, than in the summer. Various devices have been made to overcome this difficulty. Bars of metal expanding differently have been arranged in the "gridiron" pendulum so that the centre of gravity remains unaltered in position, while in the mercurial pendulum accuracy is obtained by careful adjustment of the quantity of quicksilver employed. For further details on this subject of compensation the reader is referred to books on heat.

Penelope, the faithful wife of the Greek hero Odysseus (Ulysses), whose story is told in Homer's *Odyssey*. During the wanderings of her husband on his return from the siege of Troy she was troubled by many suitors, but declared she could marry none till she had finished the winding-sheet of Laertes, Odysseus's father. Meanwhile, she always unravelled at night the part she had woven during the day. Her secret was discovered, but after a time her husband's return relieved her from further annoyance.

Penguin, any bird of the family Spheniscidæ, with three genera—Spheniscus, Eudyptes, and Aptenodytes—from the Antarctic and South Temperate regions. The body is elliptical, the head small, and the neck and bill moderately long. These birds are eminently aquatic, and when on land assume a nearly vertical position in walking or running. The wings are without quills, and are covered with short, scale-like feathers, which, in moulting, "flake off like the shedding of the skin of a serpent." The wings are, of course, functionless for flight, but make admirable swimming organs. The plumage, which covers the whole body, and is not disposed in feather-tracts, is black above and white beneath, with some white or yellow markings on the head and neck. The flesh is made by sailors into what they call, from the flavour, "hare soup," and the plumage of the head and neck is used by furriers for collars. Among the largest and best known species are the Emperor Penguin (*Aptenodytes patagonica*), and the King Penguin (*A. longirostris*).

Peninsular War, THE, is the name employed to denote the various campaigns of the French in Spain and Portugal between the years 1807 and 1814, their opponents being the Portuguese, the



PENDULUM.
Fig. 4.

Spaniards, and, for most of the period, the British. When Napoleon's intrigues in Spain culminated in the abdication of Charles IV. and the appointment of Joseph Bonaparte as King of Spain, the Spanish resisted, receiving aid from Great Britain, first in money and supplies, and eventually in troops. Sir Arthur Wellesley was sent with an army to the Peninsula in 1808, but was soon superseded, though in 1809 he again returned to it after the death of Sir John Moore at Corunna. Napoleon was called away by his campaign in Germany, just as, later, his Russian expedition prevented his having a personal share in the Peninsular War. Though Wellesley, or Lord Wellington, as he soon became, drove Marshal Soult out of Portugal, he could not follow up his success, and was forced to retire within the lines of Torres Vedras, where he wearied out Soult, and in 1811 he again forced him to evacuate Portugal. Although the French had many successes, Wellington defeated Masséna at Fuentes d'Oñoro and Albuera, and took Ciudad Rodrigo. The war languished in an indecisive way till Wellington's appointment to the chief command of the Spanish and Portuguese armies in addition to his own enabled him to enter upon more vigorous measures. In 1813 he defeated Soult in the battles of Vittoria and Nivelle, and the war ended with the battle of Toulouse, which took place after Napoleon's abdication.

Penn, WILLIAM (1644–1718), the founder of the colony of Pennsylvania, was born in London, and studied at Christ Church, Oxford, where he became a convert to Quakerism. The violence with which he attempted to assert his views led to his expulsion from the university, and his father, Admiral William Penn, refused to receive him into his house. He allowed him to travel, however, hoping that new scenes would divert his thoughts from religion, and afterwards placed him in charge of his estates in Ireland; but Penn clung resolutely to his opinions, and his father, perceiving the futility of all interference, became reconciled to him, and, at his death in 1670, left him his fortune. Meanwhile an attack on Anglican doctrines, entitled *The Sandy Foundation Shaken*, had resulted in Penn's imprisonment in the Tower (1688), where he consoled himself with the composition of *No Cross No Crown*. After a second imprisonment—this time in Newgate—in 1671, he travelled in Holland and Germany in support of Quakerism. In 1681 he received a grant of the fertile region N. of Maryland and W. of the Delaware in payment of the debts due from the Crown to his father. In consequence of its wide forests, he gave it the name “Sylvania,” the first syllable being added by the king in honour of his father. On his arrival in the New World he laid out the town of Philadelphia, and for two years governed his colony with prudence and success, returning to England in 1684. Pennsylvania (q.v.) was quickly peopled by religious refugees and other immigrants from England, Holland, and Germany. During the reign of James II. Penn became very intimate with the king, who had been a close friend of his father's; he was even suspected of sharing his unconstitutional designs, but there appears to be

no ground for the charges brought against him by Macaulay. He was deprived of his government in 1692, but received it again in 1694. His closing years were much hampered with debt, and he passed some time in the Fleet. He died at Rushcombe, in Berkshire.

Pennant, THOMAS (1726–98), traveller, antiquary, and naturalist, was born on his father's estate of Downing, in Flintshire, and studied at Queen's College, Oxford, but left without taking a degree. Besides several scientific works, which are now out of date, he wrote accounts of *Tours in Scotland* (1771–75) and *Wales* (1778–81), which have a literary as well as an antiquarian value.

Pennatulida, or “SEA PENS,” an order of Alcyonaria (q.v.), characterised by the free habit of the colonies and the fact that the individuals or zooids occur usually on a long, central, rod-like skeleton. The zooids are developed on two types, so that the colony is said to be dimorphic; the zooids are situated only on the upper exposed part of the colony, while the lower part is embedded in sand or mud. In some genera, such as the “Cock's-comb” or *Pennatula*, the zooids are borne on lateral branches from the main stem; while in others, such as *Veretillum*, they are placed directly round the central stem. The best-known English member of the order is *Pennatula phosphoria*, a small species about three inches in length; it owes its specific name to its phosphorescence when irritated. The English members of the group have been monographed by the late Professor Milnes Marshall. The Pennatulida are all marine; a few fossil forms are known, such as the *Graphularia* of the London Clay, or *Paronaria* of the Chalk. The Silurian fossil *Protovirgularia*, which has been referred to this order, is probably a Graptolite.

Pennsylvania, one of the thirteen original states of the American Union, is situated between lat. 39° 43' and 42° 15' N., and between long. 74° 40' and 80° 36' W. The extreme length from E. to W. is about 300 miles, the extreme breadth 160 miles, and the area 45,215 square miles. It is bounded by New York on the N. and N.E., New Jersey on the E., Ohio on the W., and West Virginia, Maryland, and Delaware on the S. The surface is varied, but falls into three main divisions: a level district in the S.E., extending onwards to the Atlantic; a mountainous region in the centre, which forms part of the Appalachian system, consisting of low parallel ranges running from N.E. to S.W. and separated by parallel valleys; and an upland plateau in the N. and W., from 1,000 to 2,500 feet above the sea, embracing one-half the area of the state. The mountainous region in the centre is in some places 100 miles broad. The principal rivers are the Delaware, which forms an irregular line along the E. border; the Susquehanna, which flows through the middle portion of the state from N. to S.; and the Ohio, which is formed in the W. by the union of the Alleghany and the Monongahela. The geological formation includes an Archæan region in the neighbourhood of Philadelphia, and Silurian and Devonian tracts, which

extend into this state from that of New York, whilst W. of the Alleghanies conglomerate rocks predominate. There are two great coal districts, the bituminous beds lying in the W. part of the state, and the anthracites occupying the upland region between the Delaware and the Susquehanna. They are both sources of immense wealth, but the anthracite coal, which exists in Pennsylvania alone and is practically inexhaustible, is by far the more valuable. The annual output of anthracite coal is about 34,000,000 tons, that of bituminous about 25,000,000 tons. Natural gas is another important source of power. Near Pittsburg, the centre of the bituminous district, occurred the great Homestead strike (1892), the most serious labour disturbance that has ever taken place in the United States. Iron ore is found in abundance, and large quantities of pig-iron are produced. The obtaining of petroleum is also an important industry. The manufactures are numerous and varied, especially at Philadelphia. Agriculture is also in a very thriving condition, a comparatively small portion of the soil being incapable of cultivation. The more elevated districts afford good pasturage, and dairy farming is carried on with great success. Owing to the vast quantities of timber, Pennsylvania occupies a leading position in the lumber trade, and the hemlock forests afford facilities for tanning. The original colony, established in 1681, owed its existence to the energy of William Penn (q.v.). The state is divided into sixty-seven counties, and sends twenty-eight members to Congress. The mining population includes many Irish, Italians, and Hungarians. A considerable number of the tanners are descended from a German stock, and speak a language peculiar to themselves. Harrisburg is the capital, but Philadelphia (q.v.) and Pittsburg (q.v.) are the most important towns.

Penny (probably derived from the root *pand*, "paw" or "pledge") was first used in Saxon times, and consisted of silver to the amount of $22\frac{1}{2}$ grs. troy, and the value of $\frac{1}{240}$ of the pound. The laws of Ina (7th century) speak of it, and up to the time of Edward I. it was indented with a cross, which enabled it to be broken into halfpennies and farthings. Edward I. settled its weight at 24 grs., Edward III. at 18 grs., Edward VI. at 8 grs., and Elizabeth at $7\frac{2}{3}\frac{1}{1}$ grs. Copper pennies date from 1797, and bronze coinage was introduced in 1860.

Pennyroyal (*Mentha Pulegium*), a British species of mint, with a peculiar and rather unpleasant smell. It is distilled for its essential oil, which is employed as a carminative and anti-spasmodic, and is credited with efficacy in female disorders. In the eastern United States the allied *Hedeoma pulegioides* is similarly used under the same name, and an infusion of it is popular as a remedy for colds and rheumatism.

Penobscots, North American Indians, are a branch of the Abenaki or eastern Algonquians who occupied the coast district in the State of Maine about the Lower Penobscot River and neighbouring bay named from them. Most of these are now civilised and settled in the same district, where

they form a Roman Catholic community of about 500. Another group of 300 or 400 have their camping grounds on the west side of Passamaquoddy Bay and around the shores of Lake Schoodic on the New Brunswick frontier.

Pension (Latin *pensio*, "a paying out") has had various meanings. It was sometimes equivalent to an exhibition or allowance to a scholar, and the meeting of Benchers of Gray's Inn is called a pension; but the usual meaning now attached to the word is that of a grant or allowance—generally annual—bestowed on people, whose time of work is past, for services rendered. Such are State pensions, though in times past they were granted for far other reasons, and sometimes in perpetuity. State pensions as we know them in England are Civil—granted to ministers of state, civil servants, authors or men of science; army pensions—granted to retired non-commissioners and soldiers, under varying conditions and of varying amounts; and navy pensions—which resemble in nature and conditions those of the army. Pensions are also, under certain conditions, made to widows, children, and parents of men entitled to them. Under the head of pensions may be classed the grant of money made to a winner of the Victoria Cross, if he be not of commissioned rank; the privilege to old soldiers of living in Chelsea Hospital; and the "distinguished service reward" bestowed upon commissioned officers.

Pentacrinus, the type-genus of the *Pentacrinidae*, one of the best-known families of Sea-lilies. It was most abundant in Mesozoic times, and the joints of its stems are very common in some Oolitic and Liassic beds. The stems were in some cases 80 feet in height.

Pentameter, a verse of five feet, used in Latin and Greek poetry. The first half of the verse consists of two dactyls or spondees and a long syllable; the second half of two dactyls and a syllable. Hexameters (q.v.) and pentameters, used alternately, constitute elegiacs.

Pentane. The pentanes are hydrocarbons of the paraffin series, possessing the composition represented by C_5H_{12} . According to accepted chemical theory, three varieties should exist, and all are known. *Normal pentane* is a colourless liquid, boiling at about 38° , which occurs in petroleum and light coal-tar oils. The *isopentane* boils at about 30° , and is the hydrocarbon of which the ordinary *amyl* compounds may be regarded as derivatives.

Pentateuch, the name given—possibly by the Greek translators—to the first five books of the Old Testament—*i.e.* Genesis, Exodus, Leviticus, Numbers, and Deuteronomy. They trace the history of the human race, from a Hebrew point of view, from the creation of the world to the death of Moses, the latter part of Deuteronomy being supposed to have been added by Joshua. It was formerly thought that the books were written by Moses, but modern criticism has questioned this,

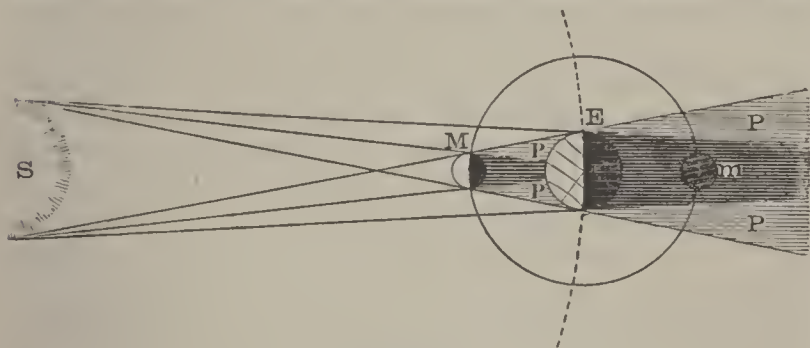
since, say some critics, there are two distinct elements—the Elohist and the Jehovist—contained in the writings. Others have held that the Pentateuch is of many ages; and others that it was chiefly written by Moses, with a possible revision by Ezra, and interpolations by others. The controversy is, however, by no means settled.

Pentecost (Greek, “fiftieth”), a name used to represent (1) the Hebrew Feast of Weeks and thanksgiving for the first-fruits, which took place fifty days after the Passover; and (2) the Christian festival of Whitsuntide, which commemorates the descent of the Holy Ghost, the first-fruits of the Spirit.

Pentremites, the typical genus of the extinct order of Echinodermata known as the Blastoidea (q.v.). It is not found in England, for the species once referred to it are now known as *Granatocrinus*.

Pentstemon, a genus of Scrophulariaceæ, native to America, consisting of herbaceous perennials with opposite leaves and showy sub-campanulate, foxglove-like flowers of various colours, characterised by a rudimentary fifth stamen. They are favourite border plants.

Penumbra. When light from a point falls upon an object a shadow of that object is cast behind it—that is, there is a region of darkness caused by the interception of the rays of light by the object. When, however, light from a surface of appreciable size falls on an object, two kinds of shadows are cast, one being a region of complete darkness and the other of partial darkness only. It is this partially dark region which is known as the penumbra. This phenomenon is of special interest when the sun is the source of light. If E and S are



the earth and sun, it is seen that there are two pairs of tangents to the circles representing sections of these bodies. The one pair meet behind E, and form the darkly shaded region known as the *umbra*. The other two tangents cross in front of E, and into the region P—part of a cone—only some light can penetrate: this is the *penumbra*. If the moon M in her path enters these regions, we have an eclipse (q.v.), the surface of the moon becoming gradually less and less bright as she passes from penumbra to umbra. The presence of the earth's atmosphere causes the rays of light to be bent slightly, so that the two cones are somewhat distorted. Also, since some rays pass through more atmosphere than others, the refraction is unequal. This, combined with the fact that watery vapour transmits differently the different

coloured rays which go to make up white light, causes the moon to appear coloured during an eclipse, the colour varying from penumbra to umbra.

Penzance, a municipal borough, seaport, and watering-place of Cornwall, pleasantly situated on the shore of Mount's Bay, 10 miles E.N.E. of the Land's End. It is the most westerly town in England. Owing to its equable climate it has lately come into great repute as a health-resort. It is an important centre of the mackerel and pilchard fisheries, and possesses an excellent harbour.

Peony (*Pæonia*), a large genus of herbaceous and shrubby plants belonging to the Ranunculaceæ, characterised by a disk below the stamens and a fruit consisting of one, two, three, or five rather fleshy follicles. *P. corallina* grows on the Steep Holm, an island in the Severn, but is not indigenous. *P. officinalis* is the common large-flowered herbaceous peony of our gardens; and *P. Montan*, sometimes placed in a distinct genus on account of the disk growing up as an irregular cup round the five carpels, is the tree-peony, said to be native to Northern China, where it grows 10 feet high and is known as “Men-tang,” the king of flowers. In English gardens it seldom reaches half that height. The flowers are white, pink, crimson, or spotted, and in cultivation are generally double.

Peoria, a town of Illinois State, U.S.A., 161 miles S.W. of Chicago by railway. It is situated on the left bank of the Illinois river, which here expands so as to form a lake. Peoria is an important railway centre, contains large distilleries, manufactures flour, oatmeal and starch, and carries on a considerable trade in grain.

Pepin, or PIPIN, THE LITTLE (d. 768), the son of Charles Martel (q.v.), and the founder of the Carolingian dynasty of Frankish kings. In 747 his brother, Carloman, withdrew to the monastery of Monte Cassino, and he became Duke of Austrasia as well as Neustria. Four years later he obtained the consent of Pope Zacharias to the deposition of Childeric III., the last of the Merovingians; and in 752 he was consecrated king of the West Franks by Boniface, Archbishop of Mainz. He aimed at strengthening the power of the Franks by a close union with the Papacy, and readily responded to the call of Stephen III., who sought his aid against the Lombard king, Aistulf (754). Eventually Aistulf was forced to become Pepin's tributary (756), and part of his territory was presented by the Frankish king to the Pope. Before this expedition Pepin had been solemnly crowned by Stephen at St. Denis. Thus his policy during these few years exercised a permanent influence on the course of mediæval history, at the same time laying the foundation of the temporal dominion of the Popes, and justifying their subsequent interference in the political affairs of Europe. The remainder of his life was spent in wars of a semi-religious character.

Pepo, the gourd or fruit characteristic of most members of the order Cucurbitaceæ. It is syncarpous, inferior, one-chambered, generally many-seeded, horny externally when ripe, and fleshy or

pulpy within. The chayote or chocho (*Sechium edule*) is exceptional in having only one large seed; the squirting cucumber (*Echallium agreste*) in bursting violently from its fruit stalk and so discharging its seeds. The pepos of various types, such as the pumpkins and snake-gourds, attain to an enormous size and assume fantastic forms: the vascular bundles of those of the towel-gourd (*Luffa ægyptiaca*) are durable; whilst our British cucurbit, the white bryony (*Bryonia dioica*) has a berry instead of a pepo—i.e. is not horny externally.

Pepper (*Piper*), the typical genus of the order Piperaceæ, which belongs to the Incompletæ (q.v.). They are mostly climbing shrubs, natives of India and the Pacific, but now cultivated throughout the tropics. They have scattered, stipulate, petiolate, simple leaves and pendulous spikes of flowers. *P. nigrum* yields the pepper of commerce. The fruit is red, is gathered when not fully ripe, and sun-dried, when it shrivels and turns black, being then known as a *peppercorn*. *White pepper* is the same fruit, with its outer coat rubbed off, but is sometimes bleached with chlorine. Pepper has been valued from early times. In the 5th century Attila the Hun is stated to have demanded 3,000 lbs. of pepper as part of the ransom of Rome. Pepper formed one of the small dying bequests of St. Bede to his comrades; and the now nominal feudal rent of peppercorns was once a reality. Malabar black pepper is the best, and Tellicherry and Penang white pepper. We import about 29 million pounds, 7 million only for home consumption. Ground pepper is adulterated with linseed, flour, ground rice, etc. Pepper is mainly used as a condiment, and owes its pungency to 2 per cent. of an essential oil. It also contains $2\frac{1}{2}$ per cent. of the tasteless crystalline alkaloid *piperin*.

Peppermint (*Mentha piperita*), a British species of mint, cultivated for its aromatic essential oil at Mitcham (Surrey), Wisbeach (Cambridgeshire), Market Deeping (Lincoln), and Hitchin (Hertfordshire), but far more extensively in New York, Michigan, and Ohio. The whole plant, especially just before flowering, is rich in the oil, and when dried it yields three or four times more than when green. The English product is nearly 20 lbs. of oil per acre. It is used for flavouring sweetmeats and cordials, to conceal the taste of medicines, and as a carminative and stimulant, especially in flatulence. It is also one of the sources of *menthol* or *Chinese oil of peppermint*, $C_{10}H_{18} + H_2O$, which is used externally in neuralgia.

Peppermint, OIL OF, is the essential oil obtained by distillation from the peppermint plant, *Mentha piperita*. The oil is a colourless liquid with a pleasant odour, and strong peculiar taste. It has a specific gravity of about .85, and acts strongly on polarised light. [POLARISATION.] If cooled, crystals of menthol form in the liquid, and it is largely used as a source of this substance. Quantities are used in medicine as an anodyne, anti-spasmodic, and in cases of diarrhoea. It is also largely employed to disguise the obnoxious taste of medicines and for flavouring purposes, but

the greatest quantity is employed for the production of peppermint lozenges.

Pepsin, a ferment found in gastric juice, capable, in the presence of weak acids, of converting proteids into peptones. For use in cases of indigestion it is introduced into the system as a medicine. The pepsin so used may be prepared from the inner surface of the stomach of calf, pig, or sheep. The stomach is laid open, washed, and scraped, the matter thus scraped off being spread on glass and dried at a gentle heat. A liquor with similar properties may be obtained by steeping the same part in glycerine. After eight days this liquor is strained, and for use a few drops may be taken in a glass of wine.

Peptones are proteid substances which are formed from all proteid material when it is subjected to the action of the gastric juice. They differ from most other proteids in their solubility and in certain of their chemical characteristics—as e.g. in not being coagulated by heat or thrown down as precipitates by mineral salts.

Pepys, SAMUEL (1633–1703), author of the famous *Diary*, was descended from an old family which had sunk so far in the social scale that his father had become a tailor in London. He received his education in the town of Huntingdon, near which his uncle owned some property, and afterwards at St. Paul's School, whence he proceeded to Cambridge in 1650, entering Magdalen College in October of that year. In 1655 he imprudently married a beautiful girl of fifteen, but the young couple were rescued from poverty by Pepys' relative, Sir Edward Montagu (afterwards Earl of Sandwich), who received them into his house. In 1660 his patron's influence secured him the office of Clerk of the Acts of the Navy, and twelve years later he was raised to the secretaryship of the Admiralty. The intelligence and zeal with which he discharged his duties made him a valuable public servant, and he earned a great reputation as an authority on matters connected with the navy. At the Revolution he lost his appointment, but the authorities continued to seek his advice on naval affairs. In 1679–80 he was confined in the Tower for nearly a year on the charge of promoting the Popish Plot, and he was again imprisoned for a short time in 1692. The *Diary*, giving in cipher an account of events from 1660 to 1669, remained in MS. till 1825, when it was published by Lord Braybrooke; but the whole of it was not given to the world till 1891. It is written with the utmost simplicity and candour, and is interesting both for its graphic picture of the court of Charles II. and the social life of the time, and for the study it affords of Pepys' own curiously complex character. Pepys was also author of *Memoirs relating to the State of the Royal Navy* (1690).

Pequods (PEQUOTS), North American Indians, members of the Algonquian family, formerly very powerful in the district west of Cape Cod (Massachusetts, Rhode Island, and Connecticut); constantly mentioned in the early annals of New England, but now quite extinct.

Pera, the name of the European quarter of Constantinople (q.v.). It is situated above Galata, and contains all the embassies and most of the hotels.

Perak, a native state under British protection, on the west coast of the Malay Peninsula. It has an area of about 7,950 square miles, covered in most places with rank vegetation. Rice, sugar, tea, coffee, and similar products are raised; but the chief industry arises from the tin-mines, which are mainly worked by Chinamen.

Perceval, SPENCER (1762–1812), English minister, was the second son of John, Earl of Egmont. He was called to the bar in 1786, and entered Parliament as a supporter of Pitt in 1796. He became Solicitor-General in the Addington Administration in 1801, and Attorney-General in 1802. In 1807 he was made Chancellor of the Exchequer under the Duke of Portland, whom he succeeded as premier in 1809. In 1812 he was shot by a madman named Bellingham in the lobby of the House of Commons.

Perch, any fish of the Acanthopterygian genus *Perca*, type of a family (Percidæ), with sixty-one genera, containing nearly five hundred species, from the rivers and coasts of temperate and tropical regions. The type-genus has three species, of which by far the best known is the river perch (*Perca fluviatilis*), fairly common in Britain and generally distributed over Europe and the northern parts of Asia and America, often coming down to brackish water. The upper surface is a warm greenish brown, shading into yellow on the sides, which are marked with broad dark vertical bands, reaching a little below the lateral line. Günther thinks five pounds the maximum weight, but much heavier specimens are said to have been taken. Perch feed on small fish, insects, and worms, and the female deposits her eggs on water plants. The flesh is esteemed for food. [CLIMBING PERCH.]

Percival, THOMAS, M.D., F.R.S. (1740–1804), a distinguished physician, was born at Warrington, and was educated there, after which he studied medicine at Edinburgh, and gained his degree at Leyden in 1765. Settling in Manchester, he acquired a large practice, and made various successful scientific experiments. He wrote largely on physical science, and in 1774–76 published his *Essays, Medical and Experimental* (3 vols.). He contributed largely to the *Transactions of the Royal Society*, and his most important papers appeared posthumously in four volumes in 1807.

Percussion is a method of diagnosis which, as ordinarily employed, consists in placing the fingers of the left hand over the portion of the chest or other part of the body to be examined, and in percussing or lightly striking them with the tips of the fingers of the right hand, so as to elicit a sound. On applying this method, for example, to the chest wall overlying the healthy lung a characteristic resonant percussion note is produced; if the chest wall overlying the heart is similarly examined, a dull sound results of quite a different

character; while if the region overlying the stomach is percussed, what is known as a tympanitic sound is evoked. By the employment of percussion, certain diseased conditions of deeply-seated organs can be detected. For example, consolidation of the lung in pneumonia, and the presence of effusion in the pleural cavity in pleurisy, both yield altered percussion sounds. Again, the altered texture of the lung in phthisis is accompanied by an altered percussion note, and changes in the form and area of the cardiac dulness are met with in certain forms of heart disease. The method of percussion was discovered by Auenbrugger in the last century, and was greatly developed by Laennec; it is commonly employed in conjunction with the method of diagnosis known as auscultation (q.v.).

Percy, a noble English family, the name being derived, it is said, from a town in St. Lô, Lower Normandy. The first of the English Percys was LORD WILLIAM, who accompanied William the Conqueror to England, and obtained grants of land in Hampshire, Lincolnshire, and Yorkshire in consideration of his services. He died in the Crusades, within view of the Holy City. At the death of his grandson, WILLIAM, the first race of the Percys died in the male line; but from one of the granddaughters of the last named a succession of distinguished knights proceeded, notably HENRY, created Earl of Northumberland in 1377, whose son, HOTSPUR, is the hero of many a romantic ballad, and is immortalised by Shakespeare. With HENRY ALGERNON, sixth earl, the peerage of the Percys ceased for a while, it being conferred on the Earl of Warwick by Edward VI. It was revived by Queen Mary in favour of the nephew of the sixth earl. The title is held at present by the Duke of Northumberland, who is connected with the old Percys, through the female side only.

Percy, THOMAS (1728–1811), Bishop of Dromore and a celebrated poetical antiquary, was connected with the great Northumberland family; he was born at Bridgnorth, Shropshire, and educated at Oxford, where he graduated in 1753, taking holy orders shortly afterwards. His first literary work was a translation from the Chinese (1761), and this was followed, after one or two minor works, by his most remarkable production, *Reliques of Ancient English Poetry* (1765). The work excited great interest and admiration, and made its author famous. He became acquainted with Dr. Johnson, Burke, and other notable men, and in 1782 was made Bishop of Dromore. A second edition of the *Reliques* was produced in 1775, a third in 1794, and a fourth in 1814. Bishop Percy published various poems of his own, including *The Hermit of Warkworth*, in three cantos (1770), and wrote the popular song, "O Nannie, wilt thou gang wi' me?" He practised much benevolence in Dromore, where he died on September 30th, 1811. A valuable collection of *Ballads and Romances* (in 3 vols.) was published from his MSS. in 1867.

Peregrine. [FALCON.]

Perennial ("living for several years"), a term applied either to plants which grow for several

years before flowering and die after producing their first crop of fruit (*monocarpic*), or to those that, though commonly not flowering in the first few years of their life, afterwards produce successive crops (*polycarpic*). They may have perennial underground structures, the aerial branches dying down annually (*herbaceous perennials*), or they may form perennial structures above ground, as in ligneous plants (shrubs and trees).

Perez, ANTONIO (1539-1611), Spanish statesman, was the son of a secretary of state to Philippe II., and on the death of his father replaced him as minister. His intrigue, ambition, and his frequent indiscretions, however, effected his disgrace, and the discovery of his amour with a mistress of Philippe's led to his imprisonment, banishment, and torture by the Inquisition. He escaped into Aragon, thence to Béarn, and afterwards to England, where he arrived in 1593. Philippe, who tried more than once to get him assassinated, was rendered even more furious by the account published by Perez in London (1594) of his relations with him. Perez went to France soon after, and died in poverty at Paris in 1611.

Perfectionists (known also as the "ONEIDA COMMUNITY," "BIBLE COMMUNISTS," and "FREE LOVERS") are a sect founded in America in 1838 by one John H. Noyes. He came to the conclusion that the Church as such hardly outlasted apostolic times, and that with the Second Advent, which he placed in the year 70, it came to an end, and that from that time forward it consisted in different times and places, of such people only, independent of priesthood or visible membership, as carried out the apostolic ideal. He conceived the idea of founding a visible church upon similar lines, the chief features of which were to be community of goods and freedom from all rules and laws, and from human ties of country, marriage, and family, since each member, by strength of the indwelling Spirit, would be a law to himself. The community eventually reintroduced marriage and family life, and modified its community of goods so far as to resolve itself into the Oneida Joint Stock Company, each member sharing in the profits. The community settled itself at Oneida Creek, New York, in 1847, and has a considerable iron and silk industry, and is noted for the Oneida trap for fur-hunting, which has driven most competitors out of the field.

Perforata. (1) A subdivision of the Foraminifera, including those in which the "test" or shell is perforated by a large number of pores through which pass the "pseudopodia" or tentacle-like expansions of the body substance. The three main families are the *Lagenidæ*, *Globigerinidæ*, and *Nummulinidæ*. (2) One of the three sub-orders of the order Madreporaria, or true corals, so called owing to the porous nature of the skeleton or corallum. It includes the most specialised of existing corals. There are three main families: the *Poritidæ*, including many massive forms composed of spongy tissue; the *Eupsammidæ*, a group of branching tree-like corals; and the *Madreporidæ*, including the common "stag's-horn coral," and others of the best known members of the order.

Perfumery, the art of extracting odours from flowers, fruits, and other substances, and combining them for use in the toilet and for other purposes. Perfumes were known to and used by the Egyptians, Phœnicians, Assyrians, and Persians, and were used by the Greeks and Romans in worship, for the toilet, and for rendering wines more agreeable. Perfumes were adopted into Christian worship as early as the 5th century. The Arabs brought the art into Spain, and it was quickly adopted and improved upon in France and Italy, though in the latter country the employment of perfumes in the fine art of poisoning led to their passing out of fashion and popularity. They were popular in England during the 15th and 16th centuries, since which time their use has considerably diminished, so far, at least, as men are concerned. Paris and London are the chief seats of the manufacture, while Cannes, Nice, Nîmes, Sicily, and other spots in Southern Europe provide quantities of the choicest flowers and fruits. Bulgaria is noted for its attar of rose, and England holds her own in the matter of lavender and peppermint, which are largely cultivated at Mitcham and Hitchin.

Pergamus, an ancient city of Lysia, in Asia Minor, was situated on the N. bank of the Caicus, which at that time communicated directly with the sea. The town centred round the Acropolis, which was on a hill behind it. Founded by a colony of Greek emigrants, it had already become important in the early part of the 3rd century B.C. As part of the territory conquered by Alexander the Great, it was ruled by his general Lysimachus; but Philetoerus revolted, and made it an independent state, and such it remained till 133 B.C., when Attalus III. bequeathed it to the Roman Empire, of which it became a province. Under the Byzantine rule it gradually fell into decay; but many things testify to its former greatness. It had a library second only to that of Alexandria, and St. John speaks of its church as one of the seven churches in Asia. There are remains of noble architecture in and about the town of Bergamah, which now occupies its site. Pergamus gives us the word "parchment," that substance having been probably first used there.

Pergolesi, GIOVANNI BATTISTA (1710-36), composer, was born at Jesi, in the Roman States, and was taught the violin at Naples. His compositions are chiefly masses and operas, which obtained little success during his lifetime. His early death excited much regret, however, and his *Maestro di Musica* (1732), *Flaminio* (1735), and *L'Olimpiade* (1735), when performed posthumously, achieved much popularity. Pathos and sweetness are the leading characteristics of his works.

Peri, in Eastern mythology, an imaginary being, of either sex, a descendant of the fallen angels, supposed to be immortal, and to live a life of happiness, but to be excluded from Paradise.

Perianth, a convenient general term for the floral envelopes [FLOWER], employed more especially when there is either only one whorl of them (*monochlamydeous*) or two whorls of similar texture,

as in many Monocotyledons. It may thus be *petaloid* in colour and texture, as in lilies, tulips, Narcissus, etc.; *herbaceous*, as in nettles; or *glumaceous*, as in rushes; and either *gamophyllous*, with united leaves, as in hyacinth; or *polyphyllous*, when they are free, as in lilies.

Pericambium, or, as it is now termed, *pericycle*, a ring of tissue surrounding the stele (q.v.) in roots or stems. It may be homogeneously composed of thin-walled parenchyma (q.v.), or it may be heterogeneous, containing a circle, or detached strands, of stereom (q.v.), either sclerenchymatous or collenchymatous. In it the lateral branches of the root originate.

Pericardium, the space surrounding the heart; it is of great functional importance in some invertebrates, such as the mollusca, in which it communicates with the exterior by means of the kidney or nephridium. In the vertebrates it is completely closed. [HEART.]

Pericarp, the wall of the ovary of angiosperms in the fruit stage, *i.e.* the whole of a true fruit (q.v.) exclusive of the seeds it contains. The term is loosely extended to the similar (analogous) structure in inferior fruits or pseudocarps, which is not identical in homology, being largely receptacular and not ovarian in origin. The pericarp may be dry or succulent. In the former case, as in the pea, it is generally dehiscent (q.v.) if many-seeded; indehiscent, as in buckwheat, if one-seeded. If fleshy, it is often readily distinguishable into three layers, the exterior skin or *epicarp* (q.v.), the middle fleshy layer, *mesocarp* (q.v.) or *sarcocarp*, and the inner stone, the *putamen* or *endocarp*. [DRUPE.]

Pericles, greatest of Athenian statesmen, was born about the close of the 6th century B.C. He was of noble descent, and was the son of Xanthippus, who routed the Persians at Mycale. He was educated by the best masters obtainable, among them being Zeno the Eleatic, and Anaxagoras. About 467 B.C. he entered public life as a member of the democratic party, and soon became its leader. He differed from many of his powerful opponents in having few traces of the demagogue about him; nor did he depend upon the generous distribution of money for supporters. Cimon, the leader of the aristocratic party, has been credited with the merit of putting an end to the long war with Persia; but it was Pericles's moderation, sagacity, and dignity which brought about that result. His magnanimity was seen in the action he took after the banishment of Cimon in passing a decree enabling Cimon to return. He had been impressed with the latter's patriotism and bravery in offering to fight at the battle of Tanagra (B.C. 457) as a common soldier. Pericles disapproved of the "spirited foreign policy" of his day, and tried to curb the impulsive enterprise of the Athenians, who were continually seeking to conquer new worlds. He wished to unite the Grecian States, which were at enmity, instead of waging war on other nations while weakened by division. He proposed that delegates from all the Hellenic States should meet

at Athens; but the jealousy and envy of Sparta prevented the realisation of his patriotic idea. The Athenians, however, united, and by a series of brilliant victories, which were largely due to Pericles's strategy and courage, gradually extended their influence and possessions from the isthmus of Corinth to the Thermopylæan Strait. After the death of Cimon and banishment of his successor, Thucydides, son of Melesias, his power was almost absolute. He subdued several states and forced tribute from them, and the treasury of the Athenian confederacy was removed during this period from Delos to Athens. He settled colonies in various places, and rendered Athens almost impregnable by the building of walls. Under his wise rule noble edifices arose in Athens, adorned with the choicest examples of Grecian art, the theatre was encouraged, and some important legal reforms were effected, his jury system standing the test of many generations. Sparta and other Grecian states, envious of Athens, conspired to humble it, and hence the Peloponnesian War. Pericles's strategy was not approved of at first, but he succeeded in his plans. Unfortunately the plague broke out in Athens, and the people turned on him. When the reaction came he had lost some of his dearest friends and relatives, and at length, in 429 B.C., he succumbed. [ASPASIA.] His orations have not been preserved, though one of them was pronounced the greatest of all ancient compositions. His fame rests on his wisdom, foresight, and splendid administrative power and military genius.

Perigee is the point of the moon's orbit which is nearest to the earth. On account of the disturbing force of the sun and the planets, the perigee does not retain the same position, but makes a complete revolution in about nine years. This motion, however, is not regular, the true position of the perigee sometimes being as much as 12° away from its mean place. This irregularity was known in very early times, but Horrocks was the first astronomer who deduced the law which determines its change.

Périgueux (Roman *Vesunna*), a French town (formerly capital of Perigord), in the department of Dordogne, is on the right bank of the Isle, and 70 miles N.E. of Bordeaux. It is well situated amid pleasant surroundings, and has some fine buildings, among them being the Byzantine cathedral (with lofty towers and cupolas), the Prefecture, the Palais de Justice, etc. It was one of eight towns ceded to the Protestants in 1576. The chief industries are the manufacture of bombazines, serge, cutlery, hosiery, leather, liqueurs and spirits, pâtés, truffles, pottery, nails, and much marble is cut and polished. Among the Roman remains are an amphitheatre, aqueducts, temples, and a curious tower 67 feet high and containing no door or window.

Perihelion is the point of any planet's orbit which is nearest the sun. It is therefore one end of the major axis of the ellipse which represents the planet's path, and it is when in perihelion that a planet is travelling fastest.

Perineum, the term applied in anatomy to the portion of the body situate at the floor of the pelvis, and traversed by the extremity of the lower bowel and by the urethra.

Periodic Law. It was first observed in the year 1864 by Newlands that if the elements be arranged in the order of their atomic weights [ATOMIC THEORY], those which showed relationship to one another in their chemical characteristics occurred at regular intervals. These elements were then classified together in groups in accordance with this periodicity, and, after further extension by Mendeleef and Lothar Meyer, the classification received general recognition amongst chemists, and might be said to take the form of law which stated that the chemical and physical properties of the elements are functions of their atomic weights. The arrangement of the elements in the periodic system is given generally as follows:—

H = 1

Li 7	Be 9	B 11	C 12	N 14	O 16	F 19	
Na 23	Mg 24	Al 27	Si 28	P 31	S 32	Cl 35.5	
K 39	Ca 40	Sc 44	Ti 48	V 51	Cr 52	Mn 55	{ Fe 56 Co 58 Ni 58
Cu 63	Zn 65	Ga 70	Ge 73	As 75	Se 79	Br 80	
Rb 85	Sr 87	Y 89	Zr 90	Nb 94	Mo 96	—	{ Ru 104 Rh 104 Pd 106
Ag 108	Cd 112	In 113	Sn 117	Sb 120	Te 126	I 126.5	
Cs 133	Ba 137	La 139	Ce 140	Di 142	Sm 151	—	{ Os 190 Ir 193 Pt 195
—	—	—		Ta 182	W 184	—	
Au 197	Hg 200	Tl 204	Pb 206	Bi 210	—	—	
—	—	—	Th 232	—	Ur 240	—	

It is seen that the elements in the vertical groups are such as closely resemble one another chemically. The periodic law has been of service in checking the atomic weights of the elements. Thus these weights in the case of Tellurium and Osmium were greater than they should be; but careful redeterminations showed the old numbers were too high. On the basis of this system also, Mendeleef predicted the existence of elements which should fill some of the gaps in the order. He also predicted the properties of these elements, his assumption being afterwards verified by the discovery of the elements Scandium and Germanium. Not least also in the uses of this discovery has been the great influence which it has had upon chemical thought and work during the past quarter of a century.

Periodic Time is the time taken by any planet to travel once round its orbit. The periodic time of an inferior planet is found by noting the time which elapses between two successive conjunctions, and that of a superior planet by observing two successive oppositions. It was discovered by Kepler that the periodic times of the different planets are connected with their respective distances from the sun, and this relationship he

expressed in his third law. [KEPLER'S LAWS.] The fact that the planets move in ellipses under the attraction of the sun makes such a relationship a mathematical necessity, but Kepler found it out by actual comparison of numbers, the mathematics of the subject remaining undiscovered till the time of Newton.

Periophthalmus, a genus of small fishes allied to the Gobies, with a few species from the shores of the Indo-Pacific. Their ventral and pectoral fins enable them to move pretty freely over mud-banks, which they frequent at low tide to hunt for small shell-fish, and their prominent eyes are suited for vision in air as well as in water.

Periostitis. [BONE.]

Peripatus is the genus which is the only member of the remarkable class known as the Protracheata or Onychophora. It is certainly one

of the most interesting and abnormal animals in the whole range of the Invertebrates. It has a soft worm-like body, with a series of rudely jointed limbs placed at equal distances along the body. The antennæ consist of a single pair; they are blunt and composed of a series of ring-like segments. The first two pairs of limbs are modified to help in feeding; the first pair acts as the jaws and are enclosed in a mouth cavity, while the second pair is represented by two papillæ, at the ends of which the slime glands discharge mucus. Breathing is effected by a series of internal respiratory tubes which ramify through the body. The functional body cavity is a "pseudocœle" [CÆLOME], while the true body cavity or cœlome is represented only by a number of small vesicles in the bases of the legs. The interest of the genus—apart from some questions of the nature of the body cavity and the course of development—is that, while it is worm-like in appearance and in the character of its nephridia or kidneys, it is more closely allied to the Myriapoda. There are numerous species which are very widely scattered, and occur in the West Indies, South and Central America, the Cape of Good Hope, Australia, and New Zealand. The animals live under leaves and stones or in decayed wood.

Periplaneta, the cockroach. [BLATTA.]

Perischœchinoidea, the principal of the four orders which form the extinct group of Palæechinoidea. It is divided into two families, the *Melonitidæ* and the *Archæocidaridæ*; the former is almost, if not entirely, restricted to America. The main character of the order is that the interambulacral plates consist of more than two rows.

Perisperm, the nutritive tissue of the seed which originates from the tericine (q.v.), or nucellus, outside the embryo-sac. It consists mainly of thin-walled parenchymatous cells rich in starch or oil, and, together with the endosperm (q.v.) within the embryo-sac, constitutes what was formerly known as albumen (q.v.). With the exception of some Alismaceæ and Orchidaceæ, almost all spermaphytes have perisperm in the early stages of the development of the seed; but in "exalbuminous" seeds it, together with the endosperm, is absorbed before the seed is ripe.

Perissodactyla, a section of Ungulata (q.v.), containing those in which the number of toes on the hind feet is odd. There are only three living families—the Rhinoceroses, the Horses, and the Tapirs. These last, and some of the Rhinoceroses, have four digits on the fore limb.

Peristaltic Movement, the peculiar movement caused by muscular contraction in the coats of the intestines.

Peristome and **Peristomium** are two terms much used in descriptive zoology and liable to be confused. The former is the area around the mouth, as in Sea-urchins, Sea-anemones, etc.; and the latter is the whole segment in which the mouth opens in worms, as in the earthworm.

Peritoneum, the closed serous sac which enfolds the abdominal organs. The *visceral layer* of the peritoneum is reflected over, and forms the outer covering of the several abdominal viscera; this layer is continuous with the *parietal layer* of the peritoneum which underlies the external abdominal wall, and between the two layers is enclosed what is known as the cavity of the peritoneum. The folds of peritoneum reflected over the intestines, and which serve to attach them to the back part of the abdomen, enclose certain blood-vessels and nerves, forming the structure which is called *mesentery*. Other connecting folds of the peritoneum are attached to other abdominal organs, and form the outer covering of the ligaments of those organs. A peculiar fold of peritoneum, which is spread over a portion of the intestines like an apron, is called the *great omentum*.

Peritonitis is inflammation of the peritoneum. The chief symptoms of this disease are intense pain, tenderness of the abdomen on pressure, and some degree of fever; there is often vomiting, and the bowels are generally confined; the abdomen may become distended either from effusion of fluid into the peritoneal cavity, or from inflation of the intestines by the accumulation of gas; the pulse may be frequent and small; and in fatal cases the

patient rapidly falls into a state of extreme collapse. Peritonitis may be due to exposure to cold, to extension of inflammation from adjoining structures, or to injury. *Perforative* peritonitis is the condition which obtains when there is a breach of continuity of the wall of one of the abdominal viscera (usually as the result of ulceration) with extravasation of its contents into the peritoneal cavity. Peritonitis also occurs as a result of tubercular and cancerous deposit, and in connection with pyæmia.

Periwinkle, the popular name of the genus *Vinca*, two species of which, doubtfully indigenous, are the only British representatives of the considerable tropical order of Gamopetalæ (q.v.), Apocynaceæ. They are prostrate perennial evergreen herbs, with wiry stems; opposite, ovate, leathery leaves; and salver-shaped, blue, white, or red flowers, an inch or more across. There are five petals: the corolla-tube is hairy inside, and has five included epipetalous stamens; and there are two superior many-seeded carpels and a single style. There is a poisonous milky latex.

Perjury is a crime committed when a lawful oath is administered on some judicial proceeding to a person who swears wilfully, absolutely, and falsely in a matter material to the issue or point in question; and under various modern statutes offences against veracity of the like sort, although not on oath, are rendered indictable and punishable as perjury—*e.g.* in the case of statutory declarations substituted for oaths. Perjury and subornation of perjury are both misdemeanours and punishable by fine and imprisonment. [DECLARATION, OATHS.]

Permanent Way, in *Engineering*, the finished track, including bridges, switches, crossings, and viaducts.

Permanent White consists of the sulphate of barium, an insoluble heavy white powder. It is largely employed as a pigment, possessing the advantages over the ordinary white lead of greater permanence and a less poisonous nature.

Permiaks, a Finnish people of North-east Russia; first mentioned as *Beormas* by King Alfred (*Orosius*, i. 14), in whose time they dwelt on the shores of the White Sea, and referred to under the name of *Perm* in the chronicles of the 10th century, but at present call themselves *Kami-mort*—*i.e.* "People of the Kama River," in which basin they are now chiefly centred. They constitute with the Votyaks and Ziryanians the Permian division of the Finnish family, and still greatly resemble the Baltic Finns both in speech and type; light or chestnut hair, grey or blue eyes, and a florid complexion being very common as in Finland. Although converted to Christianity by St. Stephen towards the close of the 14th century, they still retain many of the old Shaman superstitions, and firmly believe that the forests are everywhere inhabited by demons living in communities like their own. The Permiaks have always been hunters and fishers, though many have in recent times formed agricultural settlements on the model of the Russian *mir* ("commune"), and these tend to become rapidly absorbed in the general Russian population.

Permian System, so named by Murchison from the kingdom of Perm in Russia, where it occupies an area twice the size of France, rests upon the Carboniferous system, conformably in Bohemia, unconformably in England. In Germany, where it is well developed, it is called *Dyas*, from having two main divisions. It varies considerably in the mineral character and relative thickness of its different members, but is mainly a great series of red sandstones, sometimes containing brecciated conglomerates, and magnesian limestone. Its chief outcrop in England is a narrow band extending due north and south from the neighbourhood of Nottingham, east of the Derbyshire and Yorkshire and of the Newcastle coal-fields, along which line the Magnesian Limestone presents a scarped edge to the west. The subdivisions of the system in England and Germany are:—

ENGLAND.	GERMANY.
St. Bees' Sandstone, with gypsum.	Bunter-Schiefer (variegated shales).
Magnesian Limestone.	Zechstein (mine-stone).
Marl Slate.	Kupfer-Schiefer (copper-slates).
Penrith, or Lower Red, Sandstone, with brockrams.	Rotliegendes (red dead—i.e. non-metalliferous—layers).

The Lower Red Sandstone is 3,000 feet thick near Penrith, Cumberland, but only 250 feet in the east of England. It contains beds of breccia known as *brockrams*, containing large ice-scratched stones derived from the older rocks of the Welsh mountains. The Marl-slate is a thin bed of brown shale, chiefly seen in Durham, representing the bituminous copper-bearing bed of the Harz Mountains. The Magnesian Limestone, 600 feet thick, occurs chiefly in the eastern area, where it has yielded the building-stone for York Minster and the Houses of Parliament. The St. Bees' Sandstone, 600 feet thick in Cumberland, is far less to the east, where it passes conformably up into the Trias. Fossils are few in the Permian, but are Palæozoic in type, the plants belonging mainly to Carboniferous genera, as also do the brachiopods. The polyzoan *Fenestella retiformis*, the brachiopod *Productus horridus*, the fish *Platysomus* and *Palæoniscus*, and the lizard *Proterosaurus*, in the Marl-slate, are characteristic. Labyrinthodont footprints occur in the Penrith Sandstone, near Dumfries. Permian conditions have been compared to those of the Caspian Sea at present, many species being dwarfed as if by unsuitable surroundings, such as cold or intensely saline waters.

Permutations and Combinations, in algebra, are terms applied to the different arrangements or groups which can be made by taking some or all of a number of things. In a combination we have only to consider the *number* of things chosen, but in a permutation note is also taken of the *order* in which the things are arranged. Thus the number of combinations of two letters which can be made from the letters *a b c d* is six, the combinations being *ab, ac, ad, bc, bd, cd*; but the number of permutations which can be made from the same letters, also taken two at a time, is twelve, for if the order of the letters in the above be reversed we have

different permutations: *ab* and *ba* are the same combination, but different permutations. The fundamental problems in this branch of algebra are to find the number of permutations or of combinations which can be made from *n* different things taken *r* at a time. To find the number of permutations, we first take one of the different things. This we can do in *n* ways. We have, therefore, *n* — 1 things left behind, and so we can choose our second thing in *n* — 1 ways; but anything in the first choice can be associated with anything in the second, so altogether we can take two things in *n* × (*n* — 1) ways. Having taken out two, we have *n* — 2 things left for the third choice, and therefore we can form *n* × (*n* — 1) × (*n* — 2) permutations of the *n* things three at a time. It is to be noticed that the number of factors which the expression contains is the same as the number of things taken at a time. Hence the number of permutations of *n* things taken *r* at a time will be *n*(*n* — 1)(*n* — 2)(*n* — 3) . . . to *r* factors, which is *n*(*n* — 1)(*n* — 2)(*n* — 3) . . . (*n* — *r* + 1). If the *n* things are taken all at a time, the number of permutations is *n*(*n* — 1)(*n* — 2) . . . 1. This expression is often written *n!*, and is read “factorial *n*,” meaning the product of all the numbers from *n* down to 1. From the above, it follows that the number of combinations of *n* things taken *r* at a time is $\frac{n(n-1)(n-2)\dots(n-r+1)}{r!}$, for every

combination of *r* things gives rise to *r!* permutations. If it be required to find the number of ways in which a party of five people can be chosen out of ten, we have clearly a case of combinations, since the party will be the same in whatever order we take the people, and the required number of ways is $\frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} = 252$. But if we want to know in how many ways four people can arrange themselves in eight chairs, we are dealing with permutations, and the number of ways is

$$8 \times 7 \times 6 \times 5 = 1,680.$$

The theory of probability or chance is connected with the theory of combinations.

Pernambuco, capital of a province of the same name, is on the east coast of Brazil, at the mouths of the Capabaripe and Biberibe. It consists of three parts:—(1) Recife, so called from a reef which runs parallel to the coast, and is at the south extremity of a sandy peninsula, with the sea on the east, and Biberibe on the west, and is the chief business quarter, and contains the custom-house, bourse, etc.; and (2) united to Recife by a bridge is San Antonio upon an island of the same name, between the afore-mentioned peninsula and the mainland. In this part are broad streets and fine houses, and it contains the palaces of the president and the bishop, a theatre, arsenal, hospital, etc. A bridge leads from this to (3) Boa Vista, which is the residence of most of the European inhabitants. Trams unite the city and suburbs. A shallow harbour, with fort and lighthouse, is formed by the natural basin within the reef; and the trade of the town is extensive. The chief exports are cotton, sugar, hides, and spirits; and the imports, cotton and linen goods and

hardware, half the trade being with Great Britain. Founded in the 16th century by the Portuguese, and passing for a time into the possession of the Dutch, Pernambuco is now the third city of Brazil.

Perpendicular. 1. In *Architecture*, a style of Gothic which prevailed in England in the 15th and 16th centuries, and was contemporary with the French Flamboyant style, though not possessing its characteristic ornamentation. It is pointed Gothic, and its chief feature is the prevalence of straight vertical lines. Its windows had vertical mullions and horizontal transoms, and are noted for their large size. Other features are vaulted roofs with fan tracery, such as may be seen in King's College Chapel, Cambridge; open timber roofs, such as that of Westminster Hall; and paneling, such as may be seen in some of the colleges of Oxford and Cambridge, and in some of our cathedrals.

2. In *Geometry*, one line is said to be perpendicular to another when it makes equal angles with the other on both sides. A line is perpendicular to a plane when it makes a right angle with two lines in that plane, and in this case it can be proved that it is also at right angles to every line in the plane. Two planes are perpendicular to each other when any line in one plane perpendicular to their line of intersection is at right angles to the other plane. The word "perpendicular" is sometimes popularly used to mean vertical.

Perpetual Motion does not mean something which is for ever moving, but is a term applied to any machine or contrivance which will go on moving without any external motive power, or will do work in excess of the energy supplied to it. It is, in fact, a creator of energy, and from the very earliest times has absorbed a vast amount of attention from real and pseudo-philosophers. Though equally ancient, this problem has scarcely the respectability of the search for the Philosopher's Stone, and has certainly been less fruitful in its results. The chief addition to science which its search has produced is the denial of itself. The law of the conservation of energy, which experience has proved, can, in fact, be stated in the form that perpetual motion is impossible. Since it was invariably the custom of perpetual motors to stand still when called upon to carry out the designs of their inventors, scientists doubted from very early times the possibility of their existence. So great a nuisance did these self-imagined creators become that in 1775 the Parisian Academy of Science refused to receive any more descriptions of their schemes, and lamented the fact that many good workmen were lost by thus developing into misguided enthusiasts. Many examples of perpetual motion were worked by means of balls which alternately became nearer the inside or outside of a wheel. The balls on the outside were to overbalance those on the inside and so turn the wheel, this happy result being brought about by means of curved spokes or pivoted levers. Something of this sort was exhibited by the Marquis of Worcester in the Tower before a royal audience. The wheel of

Offyreus was reported to have been moving for eight weeks in a locked room of a castle belonging to the Landgrave of Hesse-Cassel. Its works were, however, concealed, and Offyreus destroyed their hidden portion because the mathematician's Grave-sande (who had at first been induced to believe in it) became rather curious as to its construction. Water-wheels were also—on account of their utility—the subject of much deliberation, and many a one was constructed (on paper) which considerably pumped up the water for its own use, sometimes embellished by a water-screw, but as often without. One form of perpetual motion was founded on the hydrostatic paradox: A B is a large vessel of water, B C is a narrow tube leading from its base and bent round at the top; the weight of water in A B should naturally (!) overbalance that in B C, and so water would be sent up to C, where it would drop back into the tank and go on for ever. The simplicity of this design would recommend it to all but for the trifling circumstance that it does not work. Magnetism, being little understood, was naturally invoked to act the part of creator of energy. A steel ball, B, on an inclined plane, P H, was attracted upwards by the magnet M, but reaching the hole H it fell through, rolled back to P, and again started on its upward path, continuing the cycle for ever—in the mind of its inventor. Any number of examples might be quoted of historical interest, but space does not permit it. The more modern development is that of a gas-engine which drives a dynamo machine; this generates electricity which decomposes water, and this decomposition heats the gas-engine. A simple application of the laws of dynamics and the dynamical theory of heat at once shows the impossibility of this circular and efficient combination. There is in America an alleged perpetual motor, which is, however, currently reported to derive its energy from a small boy in the next room.

Perpetuity ("unlimited duration"). The rule against perpetuities, or the doctrine of remoteness, applies to the corpus of property, real or personal, and whether limited by deed or will; it lays down that the vesting of property cannot be postponed or the alienation of it restricted beyond a life or any number of lives in being, and twenty-one years from the death of the surviving life. The principal exceptions to the rule are estates tail, charitable dispositions, and grants of property to particular families for public service.

Perpignan, a French town, capital of the department Pyrénées Orientales, is on the right bank of the Têt, 78 miles S.W. of Montpellier. It is an important fortress, as guarding the entrance from France into Spain, and has high walls and a citadel on a commanding height. Some of the public buildings date from the period of Spanish rule, the chief of them being the 14th-century cathedral. The principal manufactures are broad-cloth and woollen stuffs, playing cards, candles, leather; and there is a considerable trade in brandy, wine, cork, honey, wool, etc. The town was united to France in 1659.

Perrault, CHARLES (1628–1703), French writer, was the son of a lawyer, which profession he himself followed, being called to the bar in 1651. His great ability soon procured him an important official post, which enabled him to carry out his literary projects. In 1671 he was admitted a member of the Academy, and was instrumental in effecting several reforms in that institution. His earliest writings were slight poems and burlesques, but between 1688 and 1698 his *Parallel of the Ancients and Moderns* appeared in four volumes, and aroused great discussion. Perrault endeavoured to show that the ancients were inferior to the moderns in everything—arts, letters, science, philosophy, and even cookery. He found many adherents, and the work was the commencement of a lengthy battle between partisans of the ancients and moderns; but this and all his other writings sink into insignificance beside his delightful *Fairy Tales*, which appeared in 1697 under his son's name, and proved a revelation to Europe. They have never lost their charm, and Perrault ranks high among those who have given delight to childhood by their works.

Persepolis, an ancient Persian town, is situated in South Persia, in a fertile plain watered by the Bendemir (ancient Araxes). Founded by Cyrus or Cambyses, it became one of the capitals, and was the burial-place of the kings, as well as containing the royal treasury. It was surrounded by three granite walls of sixteen, forty-eight, and sixty feet respectively, and had brazen gates. Alexander the Great conquered it in 331 B.C., and the town, with the exception of the palace and treasury, was pillaged. Alexander is said himself to have set fire to it. In the Middle Ages the kings resided here. Among the existing remains are the Chel Minar (forty columns), part of a marble building put together without mortar, a fluted column fifty feet high, and a palace hewn in the marble. The entrance is guarded by composite animals nineteen feet high, and there are fine bas-reliefs of ceremonies, processions, etc.

Perseus, last king of Macedonia, born about 220 B.C., was the eldest son of Philip V. When quite a boy he was appointed to the command of an expedition sent to guard Pelagonia against the Illyrians. He treacherously compassed the death of his brother, whom he suspected of designs on the throne. He ascended the throne in 179 B.C., when his father died, and endeavoured to strengthen his position by conciliating the people and connecting himself with neighbouring potentates; but his avarice and ambition embroiled him with the Romans, who defeated him after a struggle of three years' duration. He was banished to Alba in 167 B.C., dying there within five years from that date. The Roman historians speak very unfavourably of him.

Persia, a kingdom of western Asia lying between Turkey in Asia, the Caspian, the Russian Trans-Caspian territory, Afghanistan, and the Persian Gulf. Its area is estimated by various authorities at between 610,000 and 660,000 square miles.

Physical Features. Modern Persia occupies the western and larger half of the so-called Iranian plateau rising between the valleys of the Indus and the Tigris. It is a section or southern spur of that great dividing range which forms the backbone of the Euro-Asiatic continent. On the west the highlands of Armenia unite the Iranian plateau with the mountains of Asia Minor, and on the east the Paropamisus and the Hindu Kush connect it with the Himalayas and Pamir highlands, whence radiate most of the chief Asiatic ranges. The average height of the plateau may be about 4,000 feet above sea-level, varying from 8,000 or higher in some of the outer valleys to not more than 500 in the most depressed portions of the centre. The plateau is thus basin-shaped, less than half of its surface draining outwards towards the Caspian and the Ocean. The most mountainous parts of the country are the provinces of Azarbaiján, Mazandaran, Ghílán, Kurdistan, Luristan, and Fars. From the south of the first-named province the Elbúrz range runs S.E. and then N.E., roughly parallel to the Caspian coast. On reaching Astrabad it sinks to lower elevations which eventually join the Paropamisus. On the north-east of Persia a hilly region, bounded by the Daman-i-koh or Kopet Dag, marks the descent to the plains of Trans-Caspia. Lastly there stretches from Azarbaiján, in a uniformly S.E. direction, a broad belt of parallel ranges, which traverse the whole extent of the country down to the Straits of Ormuz and the Arabian Sea. Speaking generally, Persia may be termed a riverless country, for, excepting the Karun, which was opened to foreign navigation in 1888, it cannot boast of one single navigable or even great stream.

Geology and Mineralogy. The geological knowledge of Persia is in a most fragmentary state. Mr. W. T. Blanford notices that recent formations are frequent, and that the whole of the great plains, covering at least half the surface of the country, consist either of a fine, pale-coloured alluvial loam, or of gravel fine or coarse, forming usually a long gentle slope from the surrounding hills to the alluvial flat. There is much geological variety in the mountains, but a few formations prevail over large areas. The Zágros chain from Mount Ararat to Shiraz consists apparently of Cretaceous (hippuritic) and Tertiary formations. In N.W. Persia there appears to be a greater development of older Mesozoic and Palæozoic formations. Metamorphic rocks (granite) and volcanic outbursts (notably Demavand, a quasi-extinct crater 18,600 feet high) are found over considerable areas. On mineralogy, as on many other heads, Mr. Curzon's recent work on Persia gives a mass of useful information.

Fauna and Flora. The same scientist (Mr. Blanford) is the best authority on the zoology, which he has described in a special illustrated work (*Eastern Persia*, Macmillan, 1876). The forests of the Elbúrz abound with wild animals, as wolves, tigers, jackals, boars, buffaloes, foxes, and the Caspian cat. Leopards and wild hogs are found in Mazandaran; jerboas in Fars; antelopes are hunted in many parts, and the wild ass all over the country. Among domestic animals the horse,

mule, camel, ass, and ox are the most important. The first, though neither so swift nor so beautiful as those of Arabia, is larger, more powerful, and better adapted for cavalry. The Turkoman breed of horses is famed for endurance, while some of the Arab breed introduced into Dashtiskán rival those of Nejd. The mules are small, but capable of enduring great fatigue; they require, however, almost twice as much food as a horse.

Climate. Persia has an extraordinarily varied climate. In the southern parts, especially the tracts adjoining the Persian Gulf, the summer heat is very great, and the climate is similar to that of Arabia, while the same may be said of some parts of the interior. The town and district of Shiraz and the rest of Fars and the plateau enjoy a fine climate, while the soil there is in general rich and productive. Proceeding northwards to Irak the climate continues to improve, and Ispahan is most pleasantly situated in this respect. Still farther north the extremes of heat and cold become more pronounced, and Teheran, the capital, is not deemed salubrious. The north-western provinces, Ghílán and Azarbaiján, are excessively cold in winter, while the Caspian tracts are characterised by much rain and general unhealthiness. The great eastern province of Khúrasán has within itself every variety of climate, and the tracts adjoining Seistan are intensely and dangerously hot, but nevertheless on the whole Khúrasán is not insalubrious.

Products. Persia is rich in undeveloped resources. Grain (mainly wheat and barley) is grown throughout the country, and is plentiful in some provinces, while rice is largely raised along the low-lying tracts of the Caspian littoral. Sugar and beetroot are grown; but the latter, though plentiful, is not manufactured so as to undersell the imported article. Cotton, silk, and tobacco are reared, and opium is an important and increasing staple and source of revenue. The southern shores of the Caspian and the rivers there flowing into the sea are richly stocked with fish, principally sturgeon and sterlet. Skins and hides are exported largely, as well as an increasing quantity of sheep's wool and goat's hair for shawls. Carpets are an ancient and famous production, the best containing from 10,000 to 40,000 stitches to the square foot. The total export of these, which is mainly to Great Britain, France, and the United States, is said to amount to about £100,000 per annum in value.

Language and Literature. The ancient idioms or forms of Persian (which belongs to the great class of the Indo-European languages) are:—(1) Zend, which died out in the 3rd century B.C. Its alphabet is of Semitic origin, and the writing runs from right to left; (2) ancient Persian, found in cuneiform inscriptions on the rocks of Behistun, etc.; (3) Pehlevi, and (4) Pazend. The transition from ancient to modern Persian is formed by the Parsee, or Farsi, in use from 700 to 1100 A.D. The purest dialect now spoken is said to be found in Shiraz, Ispahan, and the neighbourhood. The literature may be said to date from the 9th century A.D. The best-known writers are Firdusi, author of the *Shah-Naméh*; Nizami, founder of the romantic epos; Farid-ed-din Attar, the renowned

author of *Pend Nameh* ("Book of Counsel"), Jelal-ed-din Rumi, whose poem on *Contemplative Life* made him the oracle of Oriental mysticism; while Sádi and Hafiz may be said to have marked the zenith of Persian poetry. Able historians arose at an early period: Rashid-ed-din (1247-1320) wrote a summary of all Mohammedan countries and times; Sherif-ed-din was the chronicler of Tamerlane and his times. After these a simpler and less affected school of writers arose. Mirkhond, the author of a *Universal History*, and Khandemir, stand prominently in this category.

Education. In every town, city, and village in Persia there is some sort of school, though in the small villages it amounts to little more than a class, held by a *mullah* in the parish mosque. The fees are very low, amounting to from 7d. to 1s. 9d. per month for each child. Above these, in the larger towns, are *madressahs*, or religious colleges, frequented by candidates for the three learned professions—for the church, law, and medicine. There is a state-supported Royal College at Teheran, conducted on European lines, and smaller ones at Tabriz and Ispahan.

Trade. An approximate list of the value of Persian exports for 1889 is given by Mr. Curzon, among which opium, raw silk, rice, cotton, tobacco, carpets, asafoetida, dried fruits, and grain, figure most conspicuously in the order named. The total export trade is estimated as worth about £2,126,000. The import trade is eagerly fought for by both Russia and England, the former having, in the north, north-west, and south-east, an ascendancy which is balanced by British predominance in the south. The imports naturally lead off with English calico prints, white and grey shirtings, next to which come silks, satins, woollens, sugar, cloth, and spices. The total is equivalent to £3,913,100. Including specie, the value of the whole trade is estimated at from 7 to 7½ millions sterling. The principal trade routes are seventeen—viz. from Trebizond and Tiflis to Tabriz, and from Astara, on the Caspian, and Alexandretta to Tabriz; from Resht and Ser-i-Meshed to Teheran; Gez to Astrabad, Ashkabad to Meshed, Meshed to Khiva and Bokhara, Meshed to Afghanistan, India to Persia (*viâ* Afghanistan), the Bunder Abbas-Kerman-Yezd-Meshed line, the Zingah-Laristan line, the route from Bushire to Shiraz and Ispahan, the Mohamrah-Shushter-Burujird line, the route from Baghdad to Kirman-shah, and the Baghdad and Persian Kurdistan line.

Government. The Shah or monarch of Persia is one of the most absolute in the world, and his powers are believed to have been the same from the earliest ages, without further restraint than regard for religion, desire of reputation, and a fear of exciting dangerous opposition. He is nominally assisted by a Council of State of about thirty members, the seven more prominent of whom are ministers with portfolios. The system of making presents (*mudakhil* or *pishkesh*) is universal; and all offices, from the highest to the lowest, are bought and sold, the result being, as might be inferred, a most corrupt administration. The law is twofold—Shar or ecclesiastical, administered by a court of lay priests, doctors of the law, etc., under

the Sheikh-el-Islam; and the Urf or common law, administered by the civil magistrates throughout the kingdom. More important criminal cases come before the provincial governor, the ultimate appeal being to the king. The civil court, *diwan-khaneh*, is dreaded on account of its expense and uncertainty, and arbitration is preferred.

Finance. The main source of revenue is the land-tax, the principle being that one-fifth or 20 per cent. of the agricultural produce is the right of the king. In practice the taxes are farmed out by the government, and the allocation in separate areas left to the decision of local authorities. Besides this there are a herd-tax from one-third of a kran to ten krans for each beast, a trade-tax, and the custom dues, which again, in each province, district or town, are farmed out to the highest bidder. Upon foreign merchandise 5 per cent. *ad valorem* is charged at the port of entry or departure in accordance with the treaties, but more is often levied in the interior. The sum levied by the government within the ten years (1879-89) has averaged about one quarter of a million sterling per annum, but quite 20 per cent. more is actually paid on the goods. Besides these taxes and dues, an irregular revenue or *sursat*, to meet exigencies, is forcibly elicited, under the disguise of gifts, from the grandees and officials, but it is always the poor who really pay. The total revenue for the year 1888-89 was 55 million krans or £1,652,820, while the expenditure was 42 million krans or £1,260,700, showing a surplus of £392,120. The sums received by the king as fines, presents, bribes, confiscations, and gratuities are also very considerable; and the amount of hoarded bullion, secretly amassed in the royal treasury, is said to be three or four million sterling.

Mr. Curzon estimates the number of inhabitants at nine millions, which, while the country is nearly three times as large as France and five times less populous, will give an idea of the sparseness of the population.

History. The *Shah-Naméh* of Firdusi is the authority for the early history of Persia. It embodied the national legends, which laid the cradle of the race in the mountains around Ararat, where dwelt Shem's descendants, who peopled Media—the modern Azarbaiján. Here arose the first Persian or Median dynasty, the Paishadian. On these annals the Greek writers and cuneiform inscriptions form parallel commentaries. Kai-Kobad, of the ensuing Kaianian dynasty, is believed to be the Deïoces of Greek writers. He founded in Azarbaiján one of the two cities called Ecbatana, and he and his son figure in some of the achievements of the hero Rustam. About 537 the Persians rebelled against and conquered the Medes, and established a mighty empire under Kai-Khusru, or Cyrus, stretching from Asia Minor to the Indus and from Mesopotamia to the Oxus. A later monarch, Gushtasp, the Darius Hystaspes of Greek writers, built the famous palace of Persepolis, and made two fruitless attempts to subdue the Greeks, though he did succeed in adding Thrace and Macedonia to his empire. His son Xerxes (Isfandiar) was one of the first to embrace the faith of Zoroaster. He

too menaced Greek independence, but was effectually checked at Salamis and Plataea. The greatness of the Kaianian dynasty was now on the wane, and the empire itself was being weakened by intestine dissensions. Darab II., the Darius Codomanus of the Greeks, was compelled to yield his throne to Alexander the Great, whose magnificent empire on his death in 324 was split up into fragments—Persia, with Syria, falling to the Seleucidæ. The latter, however, soon lost Bakh, or Baktria, and about 246 a chieftain named Arsaces threw off the Greek yoke and established the Parthian Empire, to which Baktria was annexed. For five centuries in all, Persia groaned under the tyranny of the Greeks and Parthians, till Ardeshir (Artaxerxes) founded the Sassanian dynasty. These kings raised Persia to a height of power and prosperity which it had never attained before. Shapur I., son of Ardeshir, defeated the Romans under their emperor Valerian, whom he took prisoner, and his grandson, Shapur II., also fought against them; but the power of the Arabs, wrought up to fanaticism by their new faith, was beginning to arise, the religion of Zoroaster was overthrown, and after the battle of Nahavend (639 A.D.) the Sassanians gave way to the Arab rulers or Khalifates. At first Persia was regarded as an outlying dependency, but with the Abbaside dynasty (750) Baghdad became their capital and Khúrasán their favourite province; but in the 13th century the Khalifate and its minor governments sunk beneath the devastating arms of Chingiz Khan. The Mongol dynasty, erected by him on the ruins of the Khalifate, was supplanted by the Ilkhánis in 1419, but Timur the Tatar restored the glories of Iran and established a wide dominion. The era of the Sufáwi dynasty which followed is marked by the reigns of Shah Ismail and of Abbas the Great, the latter a powerful monarch, who defeated the Uzbeks and Turks, and allied himself with the English, Spanish, Dutch, and French Governments. In the reign of Sultan Husain the wild Afghans arose, invaded Persia, and captured Ispahan (1722), and since then the two countries have been not unfrequently embroiled one with another. Nádir Shah's invasion of India in 1738 is another conspicuous event in the history of Persia. Adventurous attempts were made at this time by two Englishmen, Elton and Hanway, to open up trade with Persia. The Zend dynasty, which followed on the death of Nádir, was rendered famous by the wise administration of Karím Khán. Fath Ali Sháh, the nephew of the eunuch-king, who was the first of the present Kajar dynasty, was crowned at Teheran in 1798; but was eventually dragged into hostilities with Russia, and had to surrender Derbend and several districts on the Kur. War with Russia was recommenced at the instigation of France, and in 1813 the treaty of Gulistán, followed by a fresh war and the treaty of Túrkmantai in 1828, stripped Persia of Armenia and the territories to the north, conceded to Russia the sole right of navigation in the Caspian, and inflicted a crushing war indemnity on Persia, besides other humiliations. In 1834 Fath Ali Sháh died, and Muhammad Sháh, son of Abbas Mirza, the Crown Prince,

succeeded to the throne. An attempt on the new king's part to re-establish his rule over Herat was forcibly resisted by England, who sent a small force to Kárák and caused the Shah to retreat. Nasr-ed-Din, the present Shah, succeeded on the death of his father in 1848. In spite of an agreement entered into with Colonel Sheil, the Persian Government again embarked on aggressive measures against Herat. England again protested, and after a very brief expeditionary campaign, in which General Outram at Bushire and in Khuzistan carried all before him, a treaty of peace was signed at Paris in 1857. Since then Persia has abstained from interference with the "key to India," but her frontier disputes with Baluchistan resulted in a boundary commission, under Sir F. Goldsmid, in 1872. The north-eastern frontier was settled by a treaty between Russia and Persia in 1881, and, while leading to a great extension of Russian dominion, has in conjunction with the Russian subjection of the Túrkomans, established a welcome peace along the frontier.

Ethnology. Few countries present a greater complexity of ethnical elements than Persia, which has for ages been a converging point or else a highway of migrations for Aryans, Semites, and "Turanians" (Mongolo-Tartars), that is, for all the stock races of Asia and Europe. Throughout the historic period the land has been occupied by two distinct social classes—the settled populations of the towns and cultivable districts, engaged in agriculture, trade, and the industries; and the unsettled populations of the steppes and highlands, engaged in pastoral pursuits, intertribal warfare and pillage. Owing to the physical diversities of soil and relief, these two classes, representing, as it were, the two principles of good and evil in the old Zoroastrian religion, have never amalgamated into a homogeneous Persian nationality. Each group differs from its neighbours in usages, often even in language; and the only bond of union is their common Moslem religion, nearly all the Persian peoples having been Mohammedans of the Shiáh sect since the 7th century. The great bulk of the people belong to the settled class, and these are for the most part Persians proper, more or less mixed descendants of the old Iranian race of Aryan speech, founders of the Persian monarchy, and originators of all the arts and general culture recognised as distinctly Persian. The nomad class comprises three separate groups:—(1) Iranian Aryans akin to the Persians, including the Baluchi in the south and south-east; the Kurds, with the kindred Bakhtiari, Lurs, Faili and others, in the western and northern uplands (Luristan, Persian Kurdistan, Khorasan). (2) The Arab Semites, chiefly in the south-western provinces of Fars and Khuzistan. (3) The so-called "Turanians," that is, the Turkoman, Turki and Mongolian tribes, such as the Kajars, to which belongs the present dynasty; the Afshars, a former royal tribe; the Goklans, Yomuds, Kizil-Bashi, Taemuri, Aimaks, and others scattered over the northern provinces; some now "Parsivan," *i.e.* of Persian speech; some still speaking Turki dialects, though generally familiar with Persian. This idiom, current not only throughout Persia, but also in many parts of

Afghanistan, Baluchistan and Turkistan, and long the court and diplomatic language of India, is one of the most refined and highly cultivated tongues in the world, with a continuous literature extending over nearly 1,000 years, rich especially in poetic works of great excellence—epic, narrative, lyric, and mystic. The Neo-Persian is a direct descendant of the old Iranic branch of the Aryan linguistic family, with greatly simplified grammatical forms, but somewhat overcharged with Arabic elements due to the Mohammedan influence.

Persian Gulf, THE, separates Persia from Arabia, and communicates with the Indian Ocean by the Straits of Ormuz, which are 35 miles wide. The Gulf has a length of 560 miles, with an average width of 180, and receives the Euphrates as well as some small rivers from Persia. It contains many islands, among them being Kishin, Ormuz, and Bahrein on the Arabian coast. On the Persian coast is the harbour of Bushire, and there are pearl-fisheries on the western coast.

Persigny, JEAN GILBERT [FIALIN], DUC DE (1808–72), French statesman, born at St. Germain Lespinnasse, was at first in the army, but left it to become a journalist. He devoted himself to the Imperial restoration, and was arrested and sentenced to twenty years' imprisonment. After the *coup d'état* he received the reward of his devotion, and was appointed by Louis Napoleon to various important posts, including that of ambassador to England, which he held in 1855–58 and 1859–60. He was also twice Minister of the Interior in France, and was created a duke in 1863. He withdrew from public life after the fall of the empire.

Persimmon, the Virginian date-plum (*Diospyros virginiana*), a moderately-sized tree of the United States, belonging to the ebony tribe, the round orange fruit of which, though austere, becomes edible when "bletted" or affected by frost. They are fermented into a beer and distilled for spirit in the Southern States. The bark has febrifugal properties.

Persius, otherwise AULUS PERSIUS FLACCUS (A.D. 34–62), Roman satirist, was born in Etruria, and educated there and at Rome. He became the pupil and devoted friend of Cornutus the Stoic, and was acquainted with Seneca, Lucan, and other notable Romans. His works consist of six short satires, considered much inferior to those of Horace and Juvenal, but still possessing much vigour and directness. They were enthusiastically received by the *literati* of the time, and were cited with admiration by subsequent scholars. Persius died near the Appian Way in his 28th year. His satires have been often translated into English, Dryden's version being probably the best.

Personal Equation, or PERSONAL ERROR, is the error which any particular observer is found to make in his observations quite irrespective of the errors of the instrument. The time when a star crosses the meridian has to be most accurately noted; to do this the astronomer writes down the hour and minutes from the clock when the star enters the field of view of the transit instrument.

He then counts the beats from one particular second, estimating to the tenth of a second when the star crosses each line. This is written down each time, or a revolving cylinder is connected with the pendulum of a clock, and at every second the pendulum breaks an electric circuit and causes a dot to be made on the cylinder. The observer, on seeing the star crossing each line, presses a button which breaks a circuit and also causes the production of a dot. This enables the time to be measured very nearly; but it is found that some observers are late and others premature in their observations, and so it is customary to allow for this. One well-tried observer is, as it were, taken as the zero, and the observations of all the others are reduced to what they would be if he had made them. It is found that anyone's personal error remains constant over an interval of several months; hence when a comparison has once been made between any one and the standard observer the corrections are quite simple. Personal error, of course, comes into play in every sort of measurement, and the less trained the person the greater is the error, but it is practically only in astronomy that allowance is made for it.

Personalty signifies generally any personal property in contradistinction to realty, which signifies real property. [FREEHOLD.]

Perspiration. [SWEAT.]

Perth. The capital of Perthshire, a city and parliamentary borough of Scotland, finely placed on the Tay, 33 miles N.W. of Edinburgh, and connected by railway with the principal towns of Scotland. The river is crossed by a nine-arch bridge of 880 feet and by a railway bridge. The scenery is good, and there are beautiful meadows forming respectively the North Inch along the river, containing the race-course, and the South Inch, through which passes the Edinburgh road (lined with trees and good houses). On the left bank of the Tay is the suburb of Bridgend, and beyond that Kinnoul Hill, 729 feet high. The streets are wide and regular, and there are good squares and crescents. St. John's church (now containing three churches) has a fine square tower and spire. Other buildings are the Episcopal cathedral, the county buildings, penitentiary, Marshall's Monument (containing a public library and museum of anatomy), a large railway-station, and barracks. The chief manufactures are woollens, winseys, hosiery, fancy dress goods, table-linen, rope, jute, and twine. Other industries are brewing, bleaching, dyeing, brick- and tile-making, and boat-building. Ships of 300 tons can come up to Perth, but the trade is not extensive. The cattle sales are important. The city, formerly called St. Johnston, was taken by Edward I. in 1298; and played a great part in later turbulent scenes, being taken by Cromwell in 1651 and occupied by the Highlanders in '15 and '45.

Perthes, BOUCHER DE CRÈVECŒUR DE (1788-1868), anthropologist, resided principally at Abbeville. His first work *De la Création* (published 1839-41) was followed by *Antiquités Celtiques et Antédiluviennes* and *De l'Homme Antédiluvien*. In

1863 he discovered a fossil human jaw-bone near Abbeville.

Perthes, CHRISTOPH FRIEDRICH (1772-1843), German bookseller, was born at Rudolstadt, and was placed in early youth in the business. In 1796 he commenced on his own account in Hamburg, and twenty-six years later settled at Gotha, where he died. He possessed great influence in the literary world, and published many remarkable works. He was the founder of the *Almanach de Gotha*.

Perthshire, a central county of Scotland, and fourth in size, has Aberdeen and Inverness on the N., Stirling, Clackmannan, and Kinross on the S., Fife and the Firth of Tay on the S.E., Forfar on the E., and Argyle, Stirling, Dumbarton on the W. It is 70 miles long by 66 broad, and contains 2,727 square miles of very varied scenery and character. The Grampian chain, sloping down from a height of 4,000 feet in Benlawers, and the Ochil Hills in the S.E., compose the mountains; while the county is noted for its straths and glens. The chief river is the Tay, next to which come the Forth, Earn, Teith, and others; and among the principal lochs are Tay, Ericht, Rannoch, and Katrine. The Carse of Gowrie is a fertile stretch between the Tay and the Sidlaw Hills, and here, as well as in Strathearn and other valleys, much fruit is grown. The county comes next to Argyle in the breeding of sheep, but is for the most part agricultural. Linen and cotton goods are manufactured, and the Tay salmon-fisheries are noted. The chief towns are Perth, Blairgowrie, Crieff, and Dunblane. Perthshire returns two members to Parliament.

Pertinax, HELVIUS (A.D. 126-A.D. 193), a Roman soldier who rose from centurion to emperor, was the son of a charcoal-burner, and was born either in Liguria or at Villa Martis, among the Apennines. He became successively senator, commander of the legion which chased the barbarians who were threatening to overrun Italy, Consul-Elect, Governor of Syria, Chief of the Commissariat of Rome, and Proconsul of Africa, and on the death of Commodus the tyrant, who had favoured him, reached the throne. Conspiracies, however, soon sapped his position, and, some reforms proposed by him proving very unwelcome to the soldiers, he was assassinated at the age of sixty-six, after a reign of less than three months.

Perturbations, in astronomy, are irregularities in the simple motion of one heavenly body about another, caused either by the action of other bodies or by irregularities in the shape or density of the primary body. The subject of perturbations has been specially studied with reference to the moon. [LUNAR THEORY.] This investigation was commenced by Newton, who devised the method known as the variation of parameters for its treatment. A perturbed body does not move in a true ellipse or in any simple curve, but it may be considered to have an elliptical orbit whose axes are slowly changing in length and direction while its forms and positions in space are constantly being altered by the disturbing influence of other bodies. In the case of the moon the sun's attraction is the chief

element of disturbance, but the planets have some effect as well, and these perturbations introduce enormous difficulties in the calculation of her path. The planets influence each other's motions, and it was by noticing the perturbations of Uranus, and finding the direction in which some disturbing body must lie, that Adams and Leverrier were led to the discovery of the planet Neptune.

Peru, a South American Republic, having Ecuador N., Chili S., Bolivia and Brazil E., and the Pacific Ocean on the W. Much diminished by the war with Chili (1879-83), in which it lost territory and much of its valuable guano deposits, it now contains 463,000 square miles. The scenery is grand. The Andes run through the country, presenting a bare wall of rock to the sea, and on the western side only possessing vegetation along the course of scanty rivers. Among the lofty peaks is the almost extinct volcano of Arequipa. The two ranges of the Andes enclose the Sierra plateau, which is the most populous part of the country, and has a diversified surface culminating in the heights of Pasco (14,000 feet), and Cuzco, the city Cuzco being over 11,000 feet above sea-level. Beyond the Sierra is a forest region in which dwell many tribes of wild Indians. The chief river is the Marañon, with its tributaries the Huallaja and Ucayale, with a course of 400 miles, 100 miles of which is through a narrow defile, and 200 miles through a fertile upland valley, till it quits Peru. On it are rapids seven miles long. The great elevation of the Sierra plateau renders breathing difficult, but the whole district is rich in metals. In the river valleys quinoa, sugar, grain, and fruit are cultivated. The lakes are unimportant. The largest, Titicaca, is partly in Peru, partly in Bolivia, and on the plateau of Pasco are two lakes, in one of which the Marañon rises. Lima, with its port Callao, is the capital, other important towns being Arequipa, Cuzco, Puno, and Truxillo. Much of the country is of volcanic formation, and there are large deposits of salt, nitre, and nitrate of soda, especially in the parts ceded to Chili. Gold abounds in the neighbourhood of Truxillo and Lima, and much is found and washed secretly by the Indians. Silver is still more abundant, especially in the Cerro de Pasco and at Hualgayoc. It is computed that since the time of the first occupation by the Spaniards, silver to the value of nearly £3,000,000 has been extracted. Quicksilver, copper, iron, and lead are found, but difficulty of carriage is an obstacle to the successful working of them. Cinchona, coca, the vine, tobacco, sugar, cotton, and fruits are cultivated, and among the exports—two-thirds of which go to Great Britain—are gold and silver, cinchona, guano, nitre, alpaca, chinchilla skins, hides, and straw hats, while manufactured goods are imported. The climate of Peru has a great range. On the coast there is neither rain nor cloud, but the wet seasons send down much water from the uplands, and from this arises thick mists, while the cool currents from the sea and from the Andes temper the atmosphere, the temperature at Lima ranging from 60° to 82°. In the western rainless districts oranges and other fruits

abound near the rivers, tropical plants in the mist-laden regions, and in the Sierra are pastures, and cereals are cultivated. The eastern part is tempered by moist equatorial winds and rain, the upper parts being clothed with forest, and the lower fertile valleys enjoying a delightful climate. Peru has suffered much at various times from earthquakes. The constitution is modelled on that of the United States. The army is small, and the navy has almost disappeared. The population is half Indian—the Quichuas in the N. and the Aymara in the S. The rest are Creoles and Mestizoes in equal proportion, and there are many Chinese coolies. The Quichuas speak the Peruvian language proper, and that, together with the dialects of the Aymaras, represents the language of the Incas, when Peru had attained a high degree of civilisation, as the ruins and relics of that period show. In 1532 Pizarro conquered the Inca Atahualpa, and Spain ruled till the struggle for independence (1821-24). In 1836 Peru and Bolivia united, to separate again in 1839, since which time there have been constant turmoils. In 1879 Peru and Bolivia united against Chili, and were utterly worsted in 1883, Peru having to cede Tarapaca permanently and Tacna and Arica temporarily to Chili.

Perugia (Latin, *Perusia*), capital of the Italian province of the same name, is on the top and slope of a hill above the Tiber, 84 miles N. of Rome. It has lofty walls and a citadel, and is well built. Among the chief buildings are the 15th-century cathedral (with fine library of MSS.), the churches of St. Agnese (with Perugino's frescoes), St. Bernardino (with façade of marble and terracotta), St. Pietro (with marble pillars from an ancient temple and some valuable paintings), the Bourse (with frescoes by Perugino), and there remains an Arch of Augustus, put together without cement. The manufactures and trade are of little importance. The province, which contains 3,750 square miles, is traversed in parts by spurs of the Apennines, and watered by the Tiber and its tributaries. It produces corn, wine, oil, fruits and silk.

Perugino, otherwise PIETRO VANNUCCI (1446-1523), one of Raphael's teachers, was born at Città della Pieve, near Perugia, and was a fellow-student with Leonardo da Vinci at Florence about 1475. He produced many fine frescoes for Italian churches, but some of his earliest have perished, and perhaps the oldest examples of his work in existence are those in the Sistine Chapel at Rome commenced by him about 1480. Though he lived chiefly in Florence, he kept up his connection with Perugia, and it was there that he received Raphael as a pupil. His works being mostly religious, they are for the most part to be found in the leading Italian churches. The National Gallery possesses a couple of his pictures.

Peruvian Bark, the name still retained in our Trade Returns for the bark of the cinchona, from which quinine is prepared, though but a small part of that imported now comes from Peru or even from South America. *Cinchona* is a genus of evergreen trees belonging to the order Rubiaceæ,

including thirty-six species, about a dozen of which are utilised. They are natives of the Andes, between lat. 10° N. and 22° S., growing mostly between 5,000 and 8,000 feet above the sea-level. In 1638 the Countess of Chinchon, wife of the governor of Peru, was cured of a fever by this bark, and it was afterwards known as Jesuits' bark, because its use was disseminated throughout Europe by the Society of Jesus. In 1860, under the superintendence of Mr. Clements Markham, plants were taken from Peru to the Neilgherry Hills, and Sir Robert Christison showed that sulphate of quinia is as abundant in the bark of young shoots as in that of older stems, so that the trees are now treated like osiers. Indian bark first came into our market in 1867. Our imports now average 6,500 tons, coming mostly from Ceylon and Madras, and in increasing quantities from Java. In the last century the crude "bark" was largely and successfully administered as a febrifuge, but now the crystalline alkaloids, especially quinine, quinidine, cinchonine, and cinchonidine, are extracted, and can be far more accurately dispensed. The chief species cultivated are *C. officinalis* (yielding pale cinchona), Crown or Loxa bark, *C. Calisaya*, and its variety *Ledgeriana* (yielding yellow cinchona or Calisaya bark), and *C. succirubra*, yielding red Cinchona bark.

Pesaro, a town and fortress of Italy, 20 miles N.W. of Mantua, is partly on an island and partly on the mainland, S. of the Lago di Garda, where the Mincio flows from the lake. It was one of the fortresses which formed the famous Quadrilateral, but is now of little importance.

Peshawur, in the Punjab, is the capital of a division of the same name, on a plain near the Bara, 12 miles E. of the Khyber Pass, on the direct route from Cabul to India, and so possessing an important trade. It is commanded by the fort of Bala Hissar on the N.W., and two miles west of the town are the cantonments and principal civil offices. There are some fine mosques and English buildings, and around the town are pleasure grounds and gardens.

Pessimism, in a general sense, is the habit of looking at the black side of things, and is exactly opposed to that optimism which finds everything good in this "best of worlds." Many religions strike a distinctly pessimistic note—for instance, the Buddhist, which looks on the world of matter as distinctly evil—and some forms of Christianity are not free from this reproach. In philosophy the tendency was organised into an elaborate system by Schopenhauer (q.v.).

Pestalozzi, JOHANN HEINRICH (1746–1827), the celebrated educationalist, was born at Zürich. After abandoning theology and jurisprudence in turn, he conceived the project of establishing himself in a country house in which he might receive and educate a few destitute children (1775). His farm at Neuhof near Lenzburg having failed, owing to his want of business capacity (1780), he betook himself to writing, and in 1787 published *Lienhardt and Gertrude*, in which are set forth his views

concerning the moral reform of the poor. His school for deserted children established at Stanz in 1798, under the auspices of the Swiss Directory, had to be abandoned before it had lasted a year, mainly in consequence of the war. He afterwards became the master of an experimental school at Burgdorf, which he removed to Yverdon in 1804. Pestalozzi owed much to Rousseau, and may be regarded as the forerunner of Froebel (q.v.). He laid great stress on the value of observation as a factor in education; the pupil must be induced to exercise his natural power of gaining an "intuitive" knowledge through the senses.

Pesth, a Hungarian town on the left bank of the Danube, communicates with Buda by a suspension bridge, an iron bridge, and a railway bridge. It consists of an inner town—irregularly built, but containing some good buildings and a fine quay—and suburbs, where are the principal Government buildings, barracks, etc., and a quay 1½ miles long lined with good houses. The university has a fine church and an extensive library, and there are two railway-stations. The town, which since 1873 has been united with Buda to form Budapest, is the most important town on the Danube after Vienna. Among the industries are ironworks, machine-railway-, waggon-, engine- and boiler-making, and the production of jewellery, cutlery, glass, porcelain, and majolica. The neighbourhood produces corn, wine, wool, wood, and cattle.

Petal (from the Greek *petalon*, "a leaf"), one of the leaves in the corolla (q.v.), or inner whorl of the floral envelopes, among angiosperms. It is generally attached by a narrow base, delicate in texture, and brightly coloured; and is often odorous, colour and odour serving to attract insects or birds and so secure cross-pollination. This is the main object of the petal. In structure it corresponds to the blade of a foliage-leaf, but is seldom pointed, and is sometimes contracted below into a narrow base or *claw*, as in the wallflower. Its margin may be *bifid*, as in chickweed; *fringed*, as in pinks; or cut up (*lacinate*), as in the ragged-robin.

Petalosticha, a term applied by Haeckel to one of his two divisions of the Echinoidea or Sea-urchins. It includes those in which the tube feet of one part of the ambulacra [ECHINOIDEA] are specialised to serve for respiration; this part of the ambulacrum is generally expanded and so described as petaloid. The group is, however, now broken up into three: the Clypeastroidea, Cassiduloidea, and Spatangioidea.

Petard, a 16th-century explosive instrument for destroying doors and similar obstacles to hostile entry. It was generally formed of gun-metal, and took the form of a conical hat and contained from 7 to 20 lbs. of powder. It was fastened by means of a plank and fired by a slow-match. An excellent account of the petard and its action occurs in Scott's *Woodstock*, where it is employed by Cromwell against Sir Henry Lee's dwelling. The petard is now obsolete, as bags of powder and discs of gun-cotton are more effectual.

Petchora, a river of Russia, rises in the N. of the government of Perm, on the western slope of the Ural Mountains. It flows W. then N. into the government of Archangel, then W. and N., falling by many mouths into the Arctic Ocean after a course of 900 miles, receiving in its course the Ijama, Issa, and other tributaries.

Petechiæ, the term applied to small extravasations of blood beneath the skin. [PURPURA.]

Peter, ST., was the son of John (John i. 42; xxi. 15, 16), or Jonas (Matt. xvi. 17), and appears to have been born at Bethsaida (John i. 44). He was also called Symcon (Acts xv. 14), which is usually abbreviated to Simon. The name Cephas is merely a Græcised form of the Aramaic Cepha, the meaning of which is the same as that of the Greek Petrus—viz. "stone." During our Lord's ministry he was living in Capernaum with his brother Andrew, his wife's mother being another inmate (Mark i. 29, 30). Before his call he was engaged in fishing, together with his brother and James and John, and to this occupation he returned after the Resurrection. Peter was conspicuous above the other disciples for his affectionate zeal, but his hasty words and actions called forth more than one rebuke from his Master (*cf.* Mark viii. 31–33; John xviii. 10, 11). The narrative, in John xviii., incidentally affords some interesting glimpses into his character, showing at once the genuineness of his love for Jesus and the tendency to moral cowardice against which that love was not proof. In his weakness, as in his strength, he was a special object of our Lord's regard (Luke xxii. 31, 32). Gal. i. 18 and other passages testify to the pre-eminent position which he occupied at Jerusalem after the Ascension. He shared with St. Paul the work of extending the knowledge of Christ and laying the foundations of the Church; "the gospel of the uncircumcision," says Paul, "was committed unto me, as the gospel of the circumcision was unto Peter" (Gal. ii. 7). At the Council of Jerusalem he was foremost in acknowledging the claim of the Gentiles to the same spiritual privileges as the Jews (Acts xv. 7, *seq.*); yet his want of steadfastness on this point afterwards involved him in a quarrel with St. Paul, which we may believe to have been only temporary (Gal. ii. 11–21). There is no further record of St. Peter; but, according to the ancient tradition of the Church, he was crucified at Rome, and the fact of his martyrdom is implied in John xxi. 18.

THE EPISTLES OF ST. PETER are two, the first of which is generally admitted, from internal and external evidence, to be genuine, while the authenticity of the second has been doubted: from the absence of reference to it by the early Fathers, and from its difference of style, which resembles that of St. Jude. One result of disputing its genuineness is to cast doubt on the Canon, to which it was admitted in 393. Its apologists say that the silence of the Fathers is not a convincing argument, and the difference of style may be owing to the employment of a secretary in its composition. Fragments of an apocryphal Gospel and Revelation of Peter have also recently been discovered.

Peter I., ALEXEIEVICH, or THE GREAT (1672–1725), Czar of Russia, was born at Moscow. He succeeded his half-brother Feodore, son of the Czar Alexis by his first wife, in 1682; but the intrigues of his sister Sophia, who excited a rising of the Streltzi, or militia, compelled him to share the sovereignty with his brother Ivan, a weak and incompetent youth, Sophia herself acting as regent. The training he received from the Genoese Francis Lefort convinced him of the backward and uncivilised condition of Russia; and, after the death of Ivan and the forced retirement of Sophia to a convent (1696), he set to work to raise his country to the level of the other states of Europe. In the formation of an effective army and navy he was much assisted by the counsels of Lefort. The first step in furtherance of his great scheme—the acquirement of an extensive sea-board—was the capture of Azov from the Turks in 1696. Desirous of seeing lands more civilised than his own, he travelled in Prussia, Holland, and England (1697–98), setting out in the disguise of a member of the Russian embassy, and working for some time at Amsterdam and Zaandam as a common labourer in a shipyard. From London he went to Vienna to study the tactics of the imperial army, and was about to visit Italy when a fresh rising of the Streltzi called him back to Russia. In 1700 he engaged in a war with Sweden, in which he was aided by Poland and Denmark. His forces suffered a terrible reverse at Narva (1703), and were defeated in many subsequent battles; but the victory of Pultowa (1709) compelled Charles XII. to seek refuge in Turkey, and in 1710 Peter gained possession of the Baltic provinces and part of Finland. Meanwhile he had founded the city of St. Petersburg (1703), which was to become the centre of the renovated empire. In 1711 he was drawn into a disastrous war with Turkey, and was obliged to restore Azov as the price of peace. In this year occurred his marriage with the notorious Catherine II. (q.v.). A second tour in Europe, in which he was accompanied by the empress, was followed on their return by the trial and condemnation of his rebellious son Alexis, who favoured the reactionary party in Russia (1718). He is now known to have died in prison from the effects of repeated torture. The war with Sweden, in the course of which Peter gained many advantages, ended with the Peace of Nystad (1721), Sweden renouncing all claim to Livonia, Esthonia, Ingria, Carelia, Viborg, and the neighbouring islands. The character of Peter the Great presents an extraordinary combination of apparently contradictory traits. A man of brutal passions and the lowest tastes, he nevertheless laid the foundations of Russia's greatness, not only by establishing her military and naval power and promoting foreign trade, but by his efforts to raise the tone of social intercourse, his zeal on behalf of education, and his encouragement of letters, science, and art. A so-called "will" of his, urging his successors to extend their empire, and therefore the basis of much of the traditional fear of Russian advance, is generally supposed to be spurious and to have been the invention of Napoleon I. in order to excuse his war with Russia in 1812.

Peter III., FEODOROVICH (1728-62), was the son of the Duke of Holstein and Anna, daughter of Peter I. He succeeded the Czarina Elizabeth in 1762. His German sympathies excited the greatest discontent among the nobles, who joined in a conspiracy to set his wife Catherine II. (q.v.) on the throne. Peter abdicated, but was nevertheless strangled by Orloff and other insurgents.

Peter Martyr, (1) The patron saint of the Inquisition. He was killed in 1252, (2) (PIETRO MARTIRE VERMIGLIO) (1500-62), Protestant reformer, was born at Florence. His sympathy with the doctrines of the reformers compelled him in 1542 to leave Lucca, where he was prior of San Frediano, and seek refuge in Switzerland. After holding a professorship at Strasburg he came to England in 1547, and took an active part in establishing Protestantism in this country under Edward VI. On the accession of Mary he returned to Strasburg, and in 1555 settled in Zürich, where he died.

Peter the Hermit (*circa* 1050-1115), the preacher of the First Crusade, was born of a good family at Amiens. In his youth he served as an officer under the Count of Boulogne. After his wife's death he became a monk, and finally retired to a hermitage. The statement that his zeal on behalf of the Crusade was inspired by a visit to Palestine about 1093 is now denied by competent authorities. It is even said that his share in the enterprise was confined to the part he played as leader of the first irregular body of some 10,000 men. He did not distinguish himself at the siege of Antioch (1097), where force was required to prevent him from fleeing from the camp. He died in a monastery founded by himself at Huy near Liège.

Peter's Pence, a tribute paid by England to Rome from the Anglo-Saxon period down to the Reformation. It was founded by Ina of Wessex in 721, probably for the support of an English college at Rome, and was confirmed in 790 by Offa of Mercia. It amounted to one penny per household, and was paid first as an alms, then as customary, and finally as a tax on pain of ecclesiastical censure. Elizabeth finally abolished it.

Peterborough, a city and parliamentary borough (one member) of Northamptonshire, 43 miles N.E. of Northampton, on the left bank of the Nen, and a point of junction of the Great Northern, London and North-Western, Great Eastern, and Midland railways. It is an agricultural district, and has important corn and stock markets. The cathedral, founded in 655 by Penda of Mercia, was destroyed in 870 by the Danes; and, after being enriched by Edgar and receiving the name of Goldenborough, was burnt in 1116. It underwent rebuilding during 400 years, and shows Norman, Early English, Decorated, and Perpendicular features. The west front has three pointed arches 80 feet high, with pediment and pinnacles, the whole front forming a square of 150 feet each way. It has lately been restored. Katharine of Aragon was buried in it, and there are some interesting remains in the precincts.

Peterborough, CHARLES MORDAUNT, EARL OF (1658 ?-1735), was the son of the first Viscount Mordaunt, whom he succeeded in 1675. Between 1674 and 1680 he took part in several naval expeditions to the Mediterranean. On his return he attached himself to the Whigs, and he afterwards resisted the early aggressions of James II. with so much boldness that he was forced to withdraw to Holland. After the Revolution, in which he took a prominent part, his services were rewarded with the title of Earl of Monmouth and the office of First Commissioner of the Treasury, which he held for a year. His failure to ruin his opponents by means of Sir John Fenwick's confessions (1697) was followed by his temporary withdrawal from public life. In the same year he succeeded his uncle as Earl of Peterborough. In 1705 he was sent to Spain as sole commander of the land forces and commander of the fleet in conjunction with Sir Cloudesley Shovel. His extraordinary feats in this campaign have made his name renowned in history. A night attack on the fortress of Montjuich on the south side of Barcelona resulted in the capture of the citadel (September 17), which was followed four weeks later by that of the town itself. Catalonia acknowledged the Archduke Charles, and Peterborough pressed forward into Valencia, receiving the submission of town after town as he advanced. Meanwhile the Archduke had been surrounded at Barcelona, the Duke of Anjou and Marshal Tessé investing the city by land, whilst the Count of Toulouse blockaded it by sea. He was only saved by the audacity of Peterborough, who, putting out to sea in an open boat in search of the English fleet which he believed to be approaching, returned on its flag-ship in time to force both Tessé and Toulouse to retire. The conduct of the Archduke, who persistently disregarded his advice, neglecting several opportunities of marching at once on Madrid, as well as his own jealousy of his fellow-commander Galway, led to his retirement from the war in 1707. On his return to England he joined the Tories, by whom he was sent on several diplomatic missions; but henceforward he is remembered chiefly as one of the brilliant literary circle which included among its members Swift, Atterbury, and Pope.

Peterloo (named in imitation of Waterloo, its real name being St. Peter's Field), Manchester, was the scene of a riotous meeting in favour of reform, July 16, 1819. The yeomanry, summoned by the magistrates to disperse the mob, killed eight of the rioters and wounded many others.

Petersburg, popularly but erroneously called St. Petersburg, founded by Peter the Great, and now the capital of Russia—though efforts have been made to choose some other capital—is built on the delta of the Neva, part of the town being on the land between the main stream and branches, some on the N. bank, and part on islands. Many bridges join the different portions of the town, which is connected by railway with most of the principal towns of Russia and the European system. The land is low, damp, and marshy, and subject to periodical inundations, and the alternating wet

and frost quickly destroy the buildings and monuments. The Neva is frozen for five months of the year, and the winter-cold is intense. Of the thirteen districts of the city, one of the finest is the Admiralty, and Vassilevskoi contains most of the literary and scientific institutions. On some of the islands are many summer-houses and gardens. The most striking features of the city are its gilded domes, magnificent palaces, long, wide streets—the Nevskoi Prospekt, for instance, being three miles long and 130 feet wide—extensive squares, colossal buildings, and granite quays. Owing to its size, Petersburg seems thinly inhabited, save in the lively southern quarter, the Admiralty Square, the Summer Garden, and the Neva Quays. Of the many churches, mostly Orthodox, that of St. Isaac, built (1819–58) on piles, and constantly undergoing repairs through the ravages of the climate, is of Finland granite and marble, and has the form of a Greek Cross. It possesses fine peristyles, with 112 pillars, each 60 feet in height. In the centre rises a gilded dome on granite pillars, the height to the top of the cross being 336 feet. The interior is richly adorned with precious stones, gold, silver, bronze and marble. The church of SS. Peter and Paul, in the fortress, is the burial-place of the emperors. The cathedral of Our Lady of Kazan contains a statue with ornamentation to the value of £14,000, and another cathedral is of white marble. Among the dozen imperial palaces are the old palace of St. Michael, now a military engineering school, the new palace of St. Michael, the Winter Palace on the Neva (used for court ceremonial, and containing beautiful rooms, and being the storehouse of the crown jewels), and the Hermitage Palace (containing a very fine collection of pictures). Among other monuments and buildings may be mentioned the bronze statue of Peter the Great, a column 80 feet high in memory of Alexander I., statues of Catherine II. and of Nicholas, the monument of the Russo-Turkish War, the Admiralty (with naval museum), the Arsenal (with artillery museum), the Palace of the Senate, the Academy of Sciences (with museum), the University, and the Imperial Library, many of the contents of which are plunder from Poland. A deep channel connects the city with the protecting fort of Cronstadt. Petersburg is a great manufacturing centre, the chief objects of industry being iron-founding, construction of machines, glass-making, tanning, brewing, manufacture of sugar, cotton, and tobacco, and there is a Government tapestry factory. Peter the Great began building the city in 1703 on territory taken from Sweden, and many lives were lost in its construction. In 1714 the Senate removed hither from the then capital Moscow.

Pétion de Villeneuve, JÉRÔME (1753–94), French revolutionist, was born at Chartres, and practised as an advocate in his native town. On the summoning of the States-General (1789) he was elected deputy by the Tiers État of Chartres, and in December, 1790, became president of the Constituent Assembly. In November, 1791, he succeeded Bailly as mayor of Paris. In the Convention, of which he

was the first president, he associated himself with the Girondists, joined in the attack on Robespierre in April, 1793, and was one of the twenty-two members proscribed in the following June. With several others of the party he escaped into Normandy, fled thence by sea to the Gironde, and lay concealed in a cave at St. Emilion, till the fear of discovery drove him and his companions to seek a new refuge. The bodies of Pétion and Buzot were found in a field half-devoured by wolves.

Petition of Right, (1) in law, is a petition on the part of the subject for the restitution of rights of which he has been deprived by the Crown. (2) In English history it denotes a petition presented to Charles I. by the Commons in 1628, which became law by force of the king's consent. It aimed at the abolition of certain grievances—*e.g.* taxing without consent of Parliament, raising money contrary to law, arbitrary imprisonment, imprisonment without cause shown, billeting of troops, and use of martial law in time of peace.

Petra, a now ruined city, once capital of Arabia Petrea, is situate in a narrow river valley surrounded by hills, 110 miles N. of Jerusalem. In the Bible it is spoken of as Selah and Joktheel, and is also mentioned by Strabo, Pliny, and other writers, including Josephus, and must therefore have been of considerable importance. Among the most important remains are rock temples, a ruined palace 34 yards square, with colonnades, cornice, and an arch 35 feet high leading into one of three large rooms, a theatre capable of holding 4,000 people, and a treasure-house.

Petrarch (FRANCESCO PETRARCA), (1304–74), an eminent Italian author, famous both as a lyrical poet of the first rank and as one of the earliest and most influential promoters of the revival of learning in Europe. He was born at Arezzo, where his father, a Ghibelline notary of Florence, had taken up his abode when driven from his native town. In 1313 the household removed to Avignon, which a few years earlier had become the seat of the Papal court. In accordance with his father's wishes, he studied jurisprudence at Montpellier and Bologna; but the fascination of Virgil and Cicero drew his mind wholly away from the law. After his father's death, in 1326, poverty compelled him to take orders. His first meeting with Laura took place in the church of St. Clara at Avignon on April 6, 1327. She at once became the object of a deep but hopeless passion, which did not lose its hold over him during the remainder of his life. It is said that Laura was the daughter of Audibert de Noves, and that she had recently been married to Hugh de Sade; but this tradition rests on very slender evidence. After travelling through France and Germany in search of classical MSS., he, in 1337, retired to the secluded valley of Vaucluse, where he occupied himself with his Latin epic *Africa*. His reputation reached its height in 1341, when he received the poet's laurel crown on the Roman Capitol. He now became a welcome guest at the courts of princes, and was often employed as an ambassador. Robert of Anjou, King of Naples,

had been one of his earliest and most ardent admirers; and, in spite of his republican principles, the despots of North Italy vied one with another in showing him honour. His friendship with Boccaccio, probably formed about 1343, is a matter of much importance in literary history, for it led to a renewal of the study of Greek. In 1345 occurred the most famous of his discoveries—that of the MS. of Cicero's letters at Verona. He settled at Padua in 1362, and passed the remainder of his life in the immediate neighbourhood, dying at Arquà in the Euganean Hills. Petrarch's fame now rests mainly on his *Canzoniere*, a collection of exquisitely harmonious lyrics, in which every thought and emotion prompted by his love for Laura is presented with a directness and simplicity unknown to the earlier love-poets of the Middle Ages. His Latin works are numerous, including *Africa* (an epic on the Second Punic War), *Eclogues* and *Epistles* in verse, various dialogues and philosophical treatises, and an important collection of *Letters*, which afford abundant information concerning the details of his life.

Petrel, any bird of the widely-distributed genus *Procellaria*, the number of species of which differs in various classifications. They are small oceanic birds of dusky plumage, rarely visiting land, except to breed, and seemingly delighting in



STORMY PETREL (*Procellaria pelagica*).

storm, whence sailors consider them birds of ill-omen. They have great powers of flight; the hind toe is rudimentary, and the nostrils, as in all the group (*Tubinares*), tubular. The best known species, the Stormy Petrel (*P. pelagica*), resembles a swift in general appearance, and is sooty-black in colour, with some white on the wings and tail. The name Petrel (= "little Peter") refers to the action of these birds, which often hover just above the surface, as if walking on the water.

Petroleum, an inflammable liquid which occurs naturally in the earth in various localities in Central Europe, the Caucasus, and in the United States. Such liquids have been known from early times, and were employed by the Chinese at a very remote period, while mention of them is also made by several of the classical writers. The liquid is usually obtained from its sources by boring deep wells or bore-holes. In some cases the petroleum is forced up by natural pressure, and issues in a jet at the top of the bore-hole. Usually, however, the pressure soon sinks and the petroleum has to be

pumped out artificially. The chief sources now are in the United States, notably in Pennsylvania, where the industry developed very rapidly from 1861 to 1865. Chemically petroleum consists chiefly of a mixture of hydrocarbons of the series known as the *paraffins* (q.v.). Other compounds of carbon and hydrogen are, however, frequently present. The crude liquor is purified by careful distillation. As obtained it has a specific gravity of about .75. When it is distilled, portions are separately collected. First, those portions that boil over below 65° Fahr. with specific gravity .62, then those that boil between 65° and 100° having a specific gravity of about .66, etc. In this way a number of separate fractions are obtained known under the names of *rhigolene*, *gasolene*, *naphtha*, etc. The lower boiling portions are not much used as illuminants, but are very largely employed as solvents for gums, caoutchouc, etc. The intermediate portions are largely used for illumination and fuels, the highest portions as fuels and lubricants, while a quantity solidifies on cooling, yielding solid paraffin.

Petromyzon. [LAMPREY.]

Petronius, surnamed ARBITER, a Roman satirist concerning whose personality nothing is known. It is conjectured that he is identical with the Caius Petronius mentioned by Tacitus, a courtly and profligate favourite of Nero, who was banished through the intrigues of Tigellinus, and committed suicide by opening his veins. The fragments of his *Satires* which remain, give a vivid but repulsive picture of contemporary social life.

Petropaulovski, the capital of Kamchatka (q.v.), situated on the bay of Avatcha. It has a good harbour.

Pettenkofer's Test for the presence of bile salts consists in the addition to the suspected liquid of a drop of a strong solution of cane sugar and then of sulphuric acid. If bile salts are present a bright cherry-red colour is developed.

Petty, SIR WILLIAM (1623–87), was the son of a clothier at Romsey, in Hampshire. He studied at several foreign universities, and in 1651 was appointed professor of anatomy at Oxford and of music at Gresham College. In 1652 he went to Ireland as physician to the army, and in 1654–55 completed a new survey of the lands forfeited in 1641. He was made surveyor-general of the island by Charles II. His chief invention was a double-bottomed ship, which sailed successfully from Dublin to Holyhead. He published a *Treatise on Taxes and Contributions*, *Political Arithmetie*, etc.

Petunia, a genus of South American Solanaceæ closely allied to the tobacco, *petun* being the Brazilian name for tobacco. They have sticky leaves; pentamerous bicarpellate flowers with a trumpet-shaped corolla, unequal included stamens, and one style; and a many-seeded capsule. Several species and hybrids, with flowers of many bright colours, are grown in our gardens.

Petunzite, CHINA-STONE, GROWAN, or MOOR-STONE, names (the first from the Chinese *petuntze*,

the others used in Cornwall) for the decomposed granite, free from tourmaline and black mica, to which porcelain owes its "flesh" or translucency.

Pewter consists of an alloy of lead and tin in the proportion of one part of the former to four parts of the latter. It melts more easily than either of its constituents, and possesses greater hardness. It is largely used for the manufacture of drinking vessels and kitchen utensils.

Pfeiffer, IDA (1797–1858), a celebrated traveller, born at Vienna. Her maiden name was Reyer. Her journeys extended to every quarter of the globe, including places so remote from one another as Iceland and the Moluccas, Madagascar and Peru. She published several books of travel.

Pforzheim, a manufacturing town in the Grand-Duchy of Baden, is situated on the edge of the Schwarzwald at the junction of the Norgold and Enz. It contains the remains of an ancient castle, the castle church, and Stadthaus. Among the chief industries are the manufacture of trinkets (employing many thousand hands), machine-making, making of silver-wares, tanning, bleaching, copper-working; and there are paper-, oil-, and saw-mills. The town is well served with railways, and much timber is floated to the Rhine by the Enz and Neckar. There is a considerable trade in fruit, oil, wine, and cattle.

Phædrus, a Latin poet of the 1st century A.D. who wrote fables in imitation of those known as Æsop's. He was born in Macedonia, and became the slave and eventually the freedman of Augustus. His five books of *Fables* are remarkable for their succinct and pointed style of narrative and their elegant versification.

Phæodaria, the order of Radiolaria (q.v.), which includes the most specialised forms. The members of this differ from the Nassellaria by the fact that the membrane which encloses that part of the body known as the central capsule is double and that the main mouth aperture or "astropyle" of the shell is surrounded by a dark mass or phæodium formed of rounded dark-greenish bodies known as the phæodellæ. This order and the Nassellaria together form the sub-class Osculosa. There is usually a complex skeleton, but this is absent in the group Phæocystina. All the living forms are marine; many fossil forms are also known.

Phaëthon ("the shining one"), originally identical with Helios the sun-god, but in the later mythology of Greece the presumptuous son of Helios, who induced his father to allow him to guide his chariot over the sky. The result was that the horses broke loose, and the earth would have been set ablaze if Zeus had not slain Phaëthon with his thunderbolt.

Phagedæna. [ULCER.]

Phagocytosis, the process of eating up of invading organisms by the white blood corpuscles (leucocytes). This species of activity on the part of the white blood corpuscles has been described and studied within recent years by Metschnikoff,

and great importance is attributed to it by many observers.

Phalanger, any individual of the Marsupial genus *Phalangista*, with five species, all about the size of a cat, from the East Indian Archipelago. The fur is thick and woolly, and the prehensile tail naked at the end. They are generally vegetable-feeders. [FLYING PHALANGER.]

Phalangidæ, an order of the class Arachnida (q.v.), the members of which are characterised by the extreme length of their legs and the breadth of the abdomen, which is not marked off from the cephalothorax by any marked line of separation; the abdomen is in general form like that of the spiders, but it is segmented. The typical genus is *Phalangium*; the body in the members of this genus is usually about an eighth of an inch in width, while the span of the legs is about an inch and a half. Their popular name is "harvest-men."

Phalaris, Tyrant of Agrigentum, in Sicily, in the 6th century B.C. He came to be regarded as the type of a cruel despot, owing to the legend that he burnt his victims alive in a brazen bull. This story was probably a reminiscence of human sacrifices offered to the Phœnician Baal. The first mention of the *Letters* purporting to be written by Phalaris occurs in the writings of Stobæus (circa 500 A.D.); their genuineness was doubted by Politian and Erasmus, and finally disproved by Bentley in his *Dissertation on the Epistles of Phalaris* (1697).

Phallic Worship, a general term for the rites in which the male organ of generation figures as a magical or religious emblem. These rites, which still claim many followers in India, probably had their origin among races of low culture, who hoped by their means to induce fruitfulness among their flocks and herds and fertility in their cultivated lands. The phallus, the emblem of these rites, took many shapes, as a rude stone, a pine-cone, a pillar, etc. The Jews borrowed these rites from their heathen neighbours, and their women made phallic emblems of gold and of silver (Ezek. xvi. 17). Wastropp and Wake note three phases in the representation of this emblem: (1) when it was an object of reverence; (2) when it was used as a protection against the evil eye, as it is in Italy at the present day; (3) when it was used as an emblem of licentiousness. Tylor classes phallic worship with stock-and-stone worship generally, there being no doubt that the first symbols of the gods were unhewn stones, some of which were revered long after idols—that is, figures—had become common.

Phallus. [PHALLIC WORSHIP.]

Phanerogamia (from the Greek *phaneros*, "evident"; *gamos*, "marriage") is the most common scientific name for the great sub-kingdom of the Vegetable Kingdom otherwise known as *Spermaphyta*, or as *Flowering Plants*. They are so called in contradistinction to the name Cryptogamia (q.v.) applied to all other plants, on account of their having relatively large and distinct reproductive organs collected together as a flower (q.v.).

This character is not, however, so truly distinctive as the possession of seed, to which they owe the recently-applied name of Spermaphyta. In common with the Bryophyta (q.v.) and Pteridophyta (q.v.), they generally exhibit a marked alternation of generations (q.v.), and, though only in a reduced condition, their oosphere is enclosed in an archegonium, from which the three sub-kingdoms are collectively termed *Arehegoniata*. In common with the Pteridophyta, they have a sporophyte far more developed than the gametophyte or oophyte, the latter being, in fact, mere appendages of the former, which is a plant with distinct stem and leaves (*cormophytic*) and well-developed vascular tissue. In the flower there are often leaves modified as secondary sexual organs in addition to the sporophylls, known as *sepals* and *petals*. The male sporophyll or *stamen* (q.v.) is not very similar to any structure among lower plants; and its microspores (*pollen-grains*) have a most rudimentary prothallium, consisting of one or more *included cells*, and do not produce motile antherozoids. The megaspore or *embryo-sac* is enclosed in the *ovule* or unfertilised seed which, though sometimes axial, is generally an appendage of a female sporophyll or *carpel*. [PLACENTATION.] Besides the female prothallium, or *archisperm*, a secondary similar tissue, or *metasperm*, is in some cases developed within the embryo-sac after fertilisation, and also an external nutritive tissue, or *perisperm*. The whole *seed*, enclosing these tissues and the embryo, separates from the parent plant when ripe. The sub-kingdom is primarily divided into the divisions Angiospermia (q.v.) and Gymnospermia (q.v.).

Phanerozonata, the sub-class of the Asteroidea or Starfish in which the marginal plates or ossicles are very large. In the other sub-class or Cryptozonata there are no such marginal plates as in the common Sand-star (*Asterias rubens*). The commonest English member of the Phanerozonata belongs to the genus *Astropecten*, but it is not often found except by dredging. The order includes the majority of the fossil forms.

Pharetrones, an extinct family of calcareous Sponges belonging to the order Calcispongiæ, allied to the existing family the *Leuconidæ*. It ranged from the Devonian to the Upper Chalk. Its geological distribution is of interest, as the species all seem to have lived in shallow-water deposits.

Pharisees = "SEPARATISTS," a strict sect of the Jews, not mentioned in the Old Testament, but possibly the same as the Assideans mentioned in Maccabees. The sect was probably formed in the time of Antiochus Epiphanes with a view to resisting his Græcising efforts. Their chief characteristics were intolerance and narrowness, and the overriding law by the authority of tradition; Christ accuses them of rendering the law of no effect by their tradition, and of binding undue burdens on men's shoulders. Josephus, who was one of them, tones down their views, and represents them as forming a philosophical system, but at best they seem to have been a set of bigoted Chauvinists. The Mishna, or first part of the Talmud (which dates from the 2nd century A.D.), shows their

influence, and rates highly the opinions of Hillel, Shammai and Gamaliel. This interprets the law by the light of (1) the decisions of the Great Synagogue, (2) the decrees of prophets and wise men, (3) the legal decisions of proper authorities, and forms a whole system of elaborate casuistry. The Pharisees professed great reverence for the Rabbis, and formed an exclusive sect, who looked down upon the common herd of Jews. St. Paul bears witness to their talent for persecution.

Pharmacopœia, from two Greek words signifying "a drug" and "to make." The *British Pharmacopœia* is an official publication containing a list of medicines and compounds, and the manner of preparing them, with their doses, etc., which is issued by the General Medical Council. The first *British Pharmacopœia* was published in 1864, and several editions have appeared since.

Pharynx, that portion of the alimentary tract that lies between the mouth and the œsophagus or gullet.

Phase, in physics, any one point or portion in a recurring series of changes, especially when contrasted with another point. The distance whereby one set of waves is in advance of another is known as *difference of phase*.

Phasianidæ. [PHEASANT.]

Phasmidæ. [LEAF INSECTS.]

Pheasant, any bird of the gallinaceous family Phasianidæ from eastern Asia. The family is considerably broken up by Elliot; but three sub-families—the Peacocks, the true Pheasants, and the Guinea-fowls—stand out distinctly from the rest. In the true pheasants the head may be crested or with lateral tufts, the tail is greatly elongated, and the two central feathers overlap those next on each side. In the type-genus *Phasianus* the bill is strong and of moderate length; the upper mandible convex, naked at the base, where are the nostrils, covered by a scale, and bent downward at the tip. The cheeks and skin round the eye bear no feathers, but have a warty red covering. The wings are short; the tail, which is long and wedge-shaped, is of eighteen feathers. The hind toe articulates with the tarsus, which in the male bears a sharp horny spur. The species are numerous, and the plumage of the males is always beautiful, and in some cases exceedingly brilliant; the hens are much more soberly clad. The Common Pheasant (*Phasianus colchicus*)—the Phasian bird of the Latins—commemorates in its popular and scientific names the legend that it was brought to Europe in the Argo. We know from Martial that its flesh was highly prized, and obtainable only by the wealthy. It was probably introduced into Britain before the Norman Conquest, and a licence of King John (A.D. 1199) exists for "a free warren for hares, pheasants, and partridges." The Pheasant is now fairly common in Europe, and with us it is one of the most highly-prized game-birds, with a close time from February 1 to September 30. In Britain it is rather half-domesticated than wild, for the eggs are often hatched under hens or in incubators, and the birds, young and old, regularly

fed during winter, the object of course being to raise a large head of game for battue-shooting. The young birds are chiefly fed on ants' eggs varied by artificial food, and the older ones on corn and green-food, to which meat, raisins, and potatoes are often added. When turned out, pheasants eat berries, grain, seeds, bulbs, and insects.

The male bird is about three feet long, of which the tail counts for about a half; the head and neck are steel-blue, with metallic reflections; the general plumage is orange-red and shades of brown with purplish-black markings; the tail is greenish-yellow barred with black, and with a dull red band



PHEASANT (*Phasianus colchicus*).

on each side. The hen bird has a much shorter tail, and brown plumage with darker markings, washed on the neck with red and green. Old hens, however, sometimes assume the brilliant dress of their mates; when this is the case there is generally disease of the ovaries, which renders them incapable of laying, though it is said that a hen-bird at Oulton Park which had assumed male plumage, laid a nest full of eggs and hatched them, but the young birds soon died. Pied and white varieties occur; and hybrids with other game-birds are by no means rare. They are frequently recorded in the *Field*, and often exhibited at meetings of the Zoological Society. The general weight of a cock pheasant is about $2\frac{1}{2}$ lbs., but Yarrell records the occurrence of two that turned the scale at nearly double that weight.

The Ringed Pheasant (*P. torquatus*), a native of India and China, somewhat smaller than the Common Pheasant, with which it breeds freely, has a white ring round the neck. It also is partially domesticated, and is, in some places, nearly as common as the older form.

There are several other species of the genus, many of which are kept as ornamental birds. The Golden Pheasant (*P. pictus* = *Thaumalia picta*) has reddish plumage, and a magnificent gold ruff barred with black. The Silver Pheasant (*P. nycthemerus* = *Thaumalia nycthemera*) is white above, with delicate black pencillings, and purplish-black below. Both have been introduced into British preserves, and in some cases the latter bird has driven out the native species. In Reeves's Pheasant (*P. reevesii*), with white plumage, the tail often measures over five feet in length. The Eared Pheasants, in which there is a tuft of feathers on

each side the head, belong to the genus *Crossoptilon*, and the Peacock Pheasants, with ocellated plumage, to the genus *Polyplectron*. [ARGUS, IMPEYAN PHEASANT.]

Phelps, ELIZABETH STUART (b. 1844), an American authoress, born at Andover, Massachusetts, has published *The Gates Ajar* (1868) and other popular tales.

Phelps, SAMUEL (1806-78), an actor of the school of Macready, was born at Devonport, and made his first appearance in London at the Haymarket in 1837. The representations of the plays of the best English dramatists which took place during his management of Sadler's Wells (1844-62) were unsurpassed both as regards the acting and the scenic accessories. Refined comedy was Phelps's true sphere, and in such parts as Bottom, Shallow, and Sir Peter Teazle he was almost unrivalled.

Phenols are a class of compounds obtained from benzene and its derivatives by the substitution of one or more hydrogen atoms of the Benzene ring [BENZENE] by hydroxyl (HO) groups. According to the number of hydrogen atoms so replaced, we obtain mono-, di-, or tri-hydric phenols, common examples of which are *carbolic acid*, *hydroquinone*, and *pyrogalllic acid* respectively. Although analogous to alcohols to some extent, they differ from these compounds in possessing acidic properties. They may be prepared by a number of general syntheses, and include very many of both chemically and technically important compounds.

Phenyl. [BENZENE.]

Phidias (circa 490-32 B.C.), the greatest of Greek sculptors, was born at Athens. His friend Pericles placed under his direction the enrichment of the city with temples and other new buildings, entrusting him at the same time with the execution of the more important details. The most famous of these buildings was the Parthenon, which contained a colossal statue of Athene carved by Phidias himself. Portions of the metopes, frieze and pediments, known as the Elgin Marbles, are now in the British Museum. The statue of Zeus in the Olympieum at Olympia was held to be his masterpiece. According to Plutarch, Phidias was charged with impiety because he had introduced his own portrait and that of Pericles on the shield of Athene, and thrown into prison, where he died.

Philadelphia, the third city of the United States and capital of Pennsylvania, is on the west bank of the Delaware (upon which it has a frontage of 25 miles), and 85 miles S.W. of New York. The old city was small in area, and situate between the Delaware and its tributary the Schuylkill; but now many surrounding towns, which still retain their old names, are included, and the main roads to these towns are now avenues within the city. The streets are, for the most part, at right angles to the Delaware, with intersecting streets, and are often lined with trees. Of the principal streets, Broad Street, running N. and S., is 6 miles long and 113 feet wide; and Market Street, E. and W., is 4 miles long and 100 feet wide. There are many squares,

ornamented with trees and fountains, and ferries connect the city with New Jersey. The bridges are handsome; and there is an Old Hall, in which the Declaration of Independence was made in 1776, and a City Hall, with lofty tower (530 feet high) surmounted by a 36-ft. statue of Penn. Other buildings are the Custom-house, United States Mint, United States Arsenal, post-office, Pennsylvania University, Jefferson Medical College and Hospital, and countless churches. Philadelphia is a great art centre,



PHILADELPHIA : MARKET STREET, LOOKING DOWN FROM SIXTH STREET.

and contains some good pictures. Fairmount Park, of 2,740 acres, is well-wooded and diversified. The city, being open to vessels, a railway centre, and in close connection with the coal-fields, has a large foreign, inland, and export trade. The chief objects of manufacture are woollen and cotton goods, especially carpets (in which 30,000 hands are employed); locomotives (in which 5,000 men are employed), sugar (employing 2,500 hands), petroleum, upholstery goods, iron and steel products; while there are many breweries and chemical works. Philadelphia was founded by Penn in 1682, and the next year it received a colony of Friends from Germany, Holland, and Great Britain. It had stirring times in the Revolutionary Wars, and was the scene of Abolition Riots. In 1876 the Centennial Exhibition was held here. Benjamin Franklin took up his abode in this city.

Philæ, a small island in the Nile, on the confines of Egypt and Nubia, contains many memorials of ancient Egypt, among which are the ruins of eight temples of different dates and religions, an avenue of columns, obelisks, a Roman triumphal arch, etc. The worship of Isis prevailed here far into the Christian era.

Philemon, EPISTLE TO, is supposed to have been written by St. Paul, either during his first imprisonment at Rome or during his imprisonment at Cæsarea, though some consider it to have been the work of a later writer. It is valuable as showing the attitude of early Christianity towards the slavery question.

Philemon and Baucis, in the Greek myth were an aged couple who entertained Zeus and Hermes when, travelling through Phrygia in human shape, they were denied admittance by all the other inhabitants. As a reward for their hospitality, their cottage was converted into a temple, in which they passed the remainder of their lives as priest and priestess, dying at exactly the same moment.

Philip II., KING OF MACEDONIA (382-36 B.C.), was the son of Amyntas II. He was educated at Thebes. On the death of his brother Perdiccas III. he became guardian to his nephew Amyntas, but he soon afterwards established himself as king (360 B.C.). After securing peace within his borders and bringing his army to a high state of efficiency, he set to work to enlarge his dominions. His projects were too vast to be accomplished in a lifetime; yet his tact, his dogged resolution, and his utter unscrupulousness as to the means he employed enabled him to advance a long way in their realisation. After subduing the Greek towns on the shores of the Ægean, he advanced through Thessaly as far as Thermopylæ; but, finding the pass well defended by the Athenians, he was compelled to retrace his steps (352). He now engaged in a war with Thrace, and in 347 completed his conquest of Chalkidikê by taking the town of Olynthus. An appeal from the Thebans for aid against the Phocians, their adversaries in the Sacred War, gave him the opportunity of interfering in the affairs of Hellas (346). The Phocians were conquered by a Macedonian army, and during the ensuing years Philip made such good use of the position he had thus gained that in 338 he was made commander of the forces of the Amphictyonic Council. In this capacity he set out for Greece in order to make war on the Locrians of Amphiassa. The Athenians, perceiving too late the danger which threatened themselves and their neighbours, united with the Thebans to resist his progress, but their forces were completely routed at the battle of Chæronea (338 B.C.). Master of all Greece, Philip now directed his thoughts to the other side of the Ægean. He was about to start on an expedition against Persia, when he was assassinated at the marriage of his daughter with Alexander of Epirus.

Philip II., or PHILIP AUGUSTUS, KING OF FRANCE (1165-1223), succeeded his father Louis VII., in 1180. He started with Richard I. on the Third Crusade (1190), and remained with him during the winter in Sicily, but returned to France soon after his arrival in Syria. Bent on regaining the English possessions in France, he seized every opportunity of hampering the reigning king, encouraging the sons of Henry II. to rebel against their father, intriguing with John against Richard during the latter's absence in Palestine, and supporting the claims of Arthur of Brittany against those of John. The disturbed state of England in 1204 enabled him to lay hands on Normandy, Maine, Anjou, Touraine, and part of Poitou, his pretext being that John had not fulfilled the duties of a feudal vassal. In 1214 he gained a great victory at Bouvines over Otto IV. and the Count of Flanders. The reign of Philip Augustus marks a distinct step forward in the consolidation of the French monarchy.

Philip IV., "THE FAIR," KING OF FRANCE (1268-1314), succeeded his father, Philip III., in 1285. The chief incident in his reign was his quarrel with Pope Boniface VIII., who denied his right to levy taxes from the clergy. Boniface died in 1303, and in 1305 Philip secured the election of Bertrand de Got (Clement V.). The removal of the Papal throne to Avignon four years later brought the head of the Church still more thoroughly under French influence. The persecution of the Knights Templars (1310-14), on mysterious charges of heresy and immorality, led to the complete extermination of the order in France.

Philip VI., OF VALOIS, KING OF FRANCE (1293-1350), was the son of Charles of Valois, brother of Philip IV. He became king after the death of Charles IV. in 1328. Edward III. of England claimed the throne through his mother Isabella, daughter of Philip IV.; and this dispute, together with more substantial causes of quarrel, plunged the two countries in the Hundred Years' War, which broke out in 1337. In the midst of the distress caused by war and pestilence, Philip did not scruple to burden his subjects with extortionate taxes.

Philip II., KING OF SPAIN (1527-98), son of the Emperor Charles V. and Isabella of Portugal, was born at Valladolid. His natural tendencies, the outcome of a cold and sullen disposition, were confirmed by the training he received from his ecclesiastical instructors. It was his fixed resolve to make his power absolute throughout all the dominions to which he was heir; and, without any genuine reverence for religion or virtue, he was ready on the first occasion to show himself a religious persecutor. His first wife, Mary of Portugal, died in 1545, after giving birth to the ill-starred Don Carlos (q.v.). From 1548 to 1551 he resided in the Netherlands, where he made himself extremely unpopular. In 1554 his father sent him to England to wed Queen Mary, presenting him at the same time with the kingdom of Naples and Sicily. Disappointed in his wife, who proved to be barren, and unsuccessful in his efforts to win the favour of the English, he remained in this country little more than a year. The abdication of Charles V. in 1556 made him ruler over Spain, the two Sicilies, the Duchy of Milan, the Netherlands, Franche Comté, Mexico, and Peru, besides colonies along the African coast and in the East and West Indies. A war against Henry II. of France, who was supported by Pope Paul IV., was terminated by the treaty of Câteau Cambresis (1559), restoring to Spain all the territory which had been won from Charles V. Negotiations for a marriage with the English queen Elizabeth having failed, he in 1559 espoused Isabella of France. Returning to Spain at the close of that year, he proceeded to carry out the policy to which he always adhered, stamping out every vestige of political liberty, and enforcing allegiance to the Church through the terrors of the Inquisition. His zeal on behalf of religion enabled him to take the place of the Pope as leader of the Catholic party in Europe. His methods were more congenial to his own subjects than they were to the

Netherlanders, who rose in a revolt which led to the formation of the Dutch Republic. [HOLLAND.] On the death of Henry of Portugal in 1580, Philip took possession of the kingdom, which he claimed through his mother. His expedition against England ended in utter failure [ARMADA], and his French intrigues were brought to naught by the conversion of Henry of Navarre to the Roman Catholic religion (1593). Worn out by excessive toil and harassed by repeated failures, he fell a prey to a disease brought on by his debaucheries, leaving as his heir PHILIP III. (b. 1578), son of his fourth wife, Anne of Austria.

Philip V., KING OF SPAIN (1683-1746), was the son of Louis, Dauphin of France, and grandson of Louis XV. His claim to the Spanish throne was based on the will of Charles II. He took up his abode at Madrid early in 1701, but a rival claimant appeared in the person of the Archduke Charles of Austria, and the states of Europe were drawn into the War of the Spanish Succession, which was terminated in Philip's favour by the Peace of Utrecht (1713). [ALBERONI, SUCCESSION.]

Philip the Bold (1342-1404), Duke of Burgundy, was the son of John, King of France. He was granted the duchy of Burgundy and made the premier peer of France in 1362. In 1369 he married Margaret, daughter of the Count of Flanders, and on her father's death (1384) became ruler over Flanders, the county of Burgundy, Artois, Rethel, and Nevers. His dominions prospered greatly under his enlightened government. He acted as regent of France during the mental incapacity of Charles VI.

Philip the Good (1396-1467), Duke of Burgundy, was the grandson of Philip the Bold and son of John the Fearless, whom he succeeded after his assassination in 1419. He allied himself with Henry V. of England, was one of the parties to the Treaty of Troyes (1420), and contributed in no small degree to the success of the English arms in France during the ensuing years. In 1435, however, he became reconciled with Charles VII., an event which was soon followed by the expulsion of the English from France.

Philippine Islands, a Pacific group N.E. of Borneo, E. of the China Sea, and N. of Sea of Celebes, consist of forty islands large and small, containing over 114,000 square miles, the principal islands being Luzon, Mindoro, Negros (producing much alum), Samar, and Mindanao (which produces cassia, cloves, nutmeg, and pepper). The surface is much varied by wooded mountains, plains, lakes, and rivers. In the west rain prevails from June to September, and then the rain shifts to the east. The rains cause temporary lakes, from which the heat raises much moisture, and the climate is tempered by land and sea breezes. The islands are subject to earthquakes. The chief minerals are gold, iron, copper, sulphur, coal and marble. There is much large timber, and rice, Manilla hemp, pine-apple, cocoa-palm, cotton, coffee, sugar, indigo, tobacco, tamarind, and various other fruits are cultivated. The buffalo—used in

agriculture—and cattle are also found wild, and there are horses, deer, hogs, goats, sheep, monkeys, abundant game, birds, crocodiles, fish, etc. The sea-swallows' nests are largely exported to China for food. Besides the wild tribes, such as the Negritos, who inhabit Negros chiefly, and the Itus, who resemble the Dyaks, there are the more civilised Spanish Christian subjects, who are called Tagals in Luzon and Biscayans elsewhere, and many Chinese and half-castes. The chief industries are the manufacture of textile goods, hats, cordage, cigars, and there is a great export and import trade. Manilla is the residence of the Governor-General and of the Archbishop. The islands were discovered by Magellan in 1520, and speedily became the object of much missionary work; consequently the Church has great influence. They are of much importance to Spain, and are rapidly developing.

Philips, AMBROSE (1671–1749), man of letters, was born of a good family in Leicestershire, and educated at Cambridge. On coming to London he became the friend of Addison and Steele, and a leading figure at Button's. He worked for Tonson, whose *Miscellany* (1709) opens with six *Pastorals* containing some of his most vigorous and elegant verses. Philips was always a consistent Whig. His contributions to the *Freethinker* (1711) were rewarded by the Government with the post of secretary to Archbishop Boulter in Ireland, where he eventually became judge of the Prerogative Court (1733). He died in London. Philips' plays are now deservedly forgotten. His "odes" often degenerate into a puerility which earned him the nickname of "Namby-pamby," yet such pieces as *Timely Blossom*, *Infant Fair*, are marked by a simplicity and grace which entitle them to rank amongst the best poetry of the kind.

Philips, JOHN (1676–1708), man of letters, was born at Bampton, in Oxfordshire, and educated at Winchester and Oxford. His chief work was his *Splendid Shilling* (1703), a burlesque poem, the style of which is an imitation of that of Milton.

Philistines—i.e. inhabitants of Palestine—a race who in the period of the Hebrew kings occupied the low country along the coast of Palestine. They appear to have been originally wandering emigrants, and have been thought by some to be identical with the Hyksos who invaded Egypt. In the time of Abraham they were a pastoral people, but developed a commerce and became powerful. Their five cities of Gaza, Askelon, Ashdod, Gath, and Ekron gave the Israelites much trouble; and in the time of the Judges the Philistines evidently had the upper hand, as is shown by their frequent raids. This seems to have been one of the chief reasons for which the Israelites demanded a king; and Saul and David effectually put them down. They became again independent after the Separation, and harassed the kingdom of Israel. Later we find them invading Jerusalem, and still later they were merged into the Assyrian Empire. Their language was probably Semitic, and they appear to have had a considerable coasting and inland traffic. Their chief gods were Dagon, Ashtaroth, and the fish-deity Derceto.

Phillip, JOHN, R.A. (1817–67), was born at Aberdeen. He studied at the schools of the Royal Academy, of which he became an associate in 1857, and a member in 1859. His best pictures are those illustrating Spanish life, of which he gained a knowledge during his visits to Spain in search of health.

Phillips, WENDELL (1811–84), American Abolitionist, was born at Boston, Massachusetts. He abandoned the career of a lawyer to join the anti-slavery movement, and by the fervour of his eloquence contributed greatly to its success. After the retirement of Garrison he became the leader of the party.

Phillipsia, one of the four genera of Trilobites (q.v.) which lived in Carboniferous times, and thus were the latest representatives of this great extinct group.

Philo Judæus (b. circa 10 B.C.), an Alexandrian Jew of the 1st century, who holds an important position in the history both of philosophy and religion. He belonged to the sect of the Pharisees, and received a wide education, embracing both the literature and philosophy of Greece and the religious writings of his own people. Conceiving that the knowledge of truth is not confined to any one race or age, he made it his aim to reconcile the teaching of Plato and the Academy with the Mosaic dispensation and the conception of God contained in the Old Testament; yet he never ceased to regard the Jewish Scriptures as a special revelation which, by the Divine appointment, was to be conveyed to mankind at large through the agency of the chosen race. He was zealous in maintaining the literal truth of the Pentateuch, yet he regarded it as susceptible of an allegorical interpretation also. Indeed, in his hands, the symbolical meaning often becomes the more important of the two. Philo maintains that the universe was fashioned, and is now regulated, by means of certain *dunamis* (active powers) or *hypostases*, the highest being the *Logos* or Word, whom he describes as "the High Priest," "the Shadow of God," "the Firstborn Son," identifying him at the same time with the Angel of the Covenant of the Old Testament. Concerning Philo's life few details have come down to us. He is known to have visited Jerusalem on at least one occasion, and about 40 A.D. he was the head of an embassy sent to Rome by the Jews of Alexandria to protest against the enforcement of the worship of the emperor.

Philology (literally, "study of words") is a word that has much changed its signification in course of time. Originally, it denoted what we should now call the cultivation of literature and literary criticism, and it held this signification among the Greeks and Romans and in Europe in the period which followed the Renaissance, and still retains it, to some extent, in Germany; but towards the middle of the present century it began to change its meaning and to be applied to that systematic study of the structure of languages and their affinity to each other which is more properly called Comparative Philology. In place of wildly

hypothetical conjectures and fanciful derivations, scientific methods began to be employed, and languages began to be studied geologically (*i.e.* their different strata were examined with a view to historical succession) and geographically (*i.e.* the whole field of languages mapped out and compared). The two great instruments in the progress of the science were the discovery of Grimm's Law, which established the fact that certain letters or sounds interchanged with each other in an order seldom varying in certain groups of languages; and the study of Sanskrit, which may be said to have been initiated by Sir William Jones in 1783. Knowledge of Sanskrit showed that the group of tongues now called Indo-European have evident features of kinship and that they all spring from an earlier tongue—sometimes called for convenience Aryan—which was spoken at a period when men of the race had already arrived at an important degree of civilisation and had adopted the family life which they have retained since, for words which run throughout the group express these ideas and relationships. The appearance of Bopp's *Comparative Grammar* in 1833, and the researches from that time till now by many zealous workers into Indian and Persian literature and language, have established the science upon a firm and unquestionable basis. Among the most famous workers in this direction must be mentioned Professor Max Müller, who has made Comparative Philology a life-labour. Philology has established that the languages of the world may be ranged into a few groups of which the principal known are:—(1) Aryan or Indo-European, (2) Semitic, (3) the Dravidian tongues of South India, and (4) languages of which Chinese may be taken as typical. There are many points of similarity between the Aryan and some of the Semitic tongues. The following is the generally received grouping of the Aryan and Indo-European tongues:—

ARYAN	SANSKRIT	{ Hindustani. Cingalese.	
	IRANIAN	{ Zend. Modern Persian.	
	INDO-EUROPEAN	SCLAVONIC	{ Bohemian. Russian. Polish.
		TEUTONIC	Scandinavian { Icelandic. Norwegian. Swedish. Danish.
			High German—Modern German.
		Low German	{ Flemish. Dutch. English.
		PELASGIC	Latin { French, Italian, etc., known as the Romance languages.
			Greek.
		CELTIC	Ancient Irish { Manx. Gaelic. Erse.
			Ancient British { Armorican. Welsh.

The European tongues which do not belong to the Indo-European family are the Magyar, Basque, Turkish, and those spoken by the Finns and Lapps.

Philopœmen (252–183 B.C.), general of the Achæan League, was born at Megalopolis. After taking part in the civil wars of Crete, he was in 210 placed at the head of the Achæan cavalry, and two years later became *strategos* or commander-in-chief of the League. His victory over the Spartan tyrant Machanidas at Mantinea (208) secured for Greece a period of peace which lasted several years. In his subsequent struggle with Nabis, the successor of Machanidas, he gained such advantages that in 188 the Spartans were compelled to pull down their walls and accept the laws of the Achæans in place of those of Lycurgus. Named *strategos* for the eighth time in 183, he rose from a sick bed to suppress a revolt of the Messenians, but was taken prisoner, thrown into a dungeon, and forced to drink the poisoned cup.

Philosopher's Stone. One of the most prominent features of the creed of the alchemists [ALCHEMY, CHEMISTRY] was the belief in the transmutability of all metals. The point aimed at then was, of course, the conversion of the commoner metals into the more precious gold. The agency by which this desired result was to be effected was the philosopher's stone, of the existence of which not a doubt was entertained, and many of the philosophers of the Middle Ages—*e.g.* Albertus Magnus, Roger Bacon—spent much time in the search for this *ignis fatuus*. In this respect the philosopher's stone could act without limit, and an indefinite quantity of gold could be prepared through the agency of the smallest amount of this wonderful substance. It was further endowed with other miraculous powers, being capable of curing all bodily and physical infirmities, and hence of prolonging life almost indefinitely.

Philosophy is an investigation of the first principles of human knowledge. It seeks an answer to such questions as these: Are there any propositions of the truth of which we can be certain? How is their truth to be tested—by an appeal to "experience," or by ascertaining their agreement with certain "forms" inherent in the mind itself? If nothing is found to be certain, then we get the doctrine of philosophical scepticism. If one of the other positions is taken, we have respectively philosophical experientialism or rationalism. Having found what makes knowledge valid, the philosopher goes on to determine, with more or less completeness, what is to be thought about the whole of things. The sciences deal only with the parts, and take for granted various assumptions.

Philosophy examines the assumptions, distinguishes appearance from reality, re-states the results of science in accordance with this

distinction, and brings the parts into a system. In this way philosophy becomes metaphysics. This is the course it now takes: first, critical examination of knowledge, then speculative construction. Historically, the process was the opposite. Philosophy began as a theory of the universe. The philosopher did not first try to discover whether anything can be known, and if so what can be known; but, trusting to the mind's powers, laid down some principle as certain, and proceeded to explain everything by means of it. Philosophy was not then distinguished from special science, but included science in itself. The sciences have gradually become separate, as it has been found possible or necessary to treat aspects of things apart from the whole, philosophy retaining for itself the theory of the whole and the criticism of scientific assumptions. When philosophers began with untested general principles the notion was that these, as soon as stated, were obvious. It was found, however, that different philosophers took different starting-points, and that the theories of the universe attained were quite different and even incompatible with each other. From the perception of this sprang, first, assertions that nothing could be known, then attempts at reasoned selection of true principles. It was seen that only when comparison had been made among principles was genuine philosophical construction possible. This historical movement has not taken place once for all, but has been frequently repeated. Constructive periods and critical periods have alternated, but the general result has been that critical investigation of knowledge has had to become constantly severer and more systematic. This has meant that philosophers have had to turn more and more to investigation of the mind's powers. Philosophy has thus acquired a special association with mental as distinguished from natural science. So far, only theoretical philosophy has been spoken of, but philosophy has also its practical department. Not only have we to distinguish true from apparent knowledge; we also have to learn what objects of desire are good, and what modes of action are right. Where disputes arise as to which of the various modes of action that men spontaneously adopt are directed to the proper end, or are according to the true rule, these differences have to be brought to the test of practical philosophy. Theoretical knowledge of the universe and of men in their relations to one another has to be followed by practical directions to choose certain ends, or to act according to certain rules. All knowledge has to be brought into relation with these, so as to make clear what means must be taken for attaining the ends, or for applying the general rules to particular circumstances. Thus philosophy includes ethics as well as metaphysics. It also includes æsthetics, the object of which is to discover why certain things in nature and in art are considered beautiful, to determine what really constitutes beauty, how this can be known, and how it can be realised. Philosophy, theoretical and practical, has appeared in all civilisations that have reached the stage of reflecting upon the world and upon themselves. European philosophy began in Greece

about the seventh or sixth century B.C. From then till now it has been cultivated with very different degrees of zeal and of success in different ages and countries; but during the whole period of more than two thousand years it has a history that has never been absolutely broken.

Philostratus (*circa* 175–245 A.D.), a Greek sophist and rhetorician, supposed to have been born at Lemnos. He probably taught at Rome. His works include a *Life of Apollonius of Tyana* (written by command of the Empress Julia Domna) and *Lives of the Sophists*.

Philtre, a love-potion, a draught supposed to have the virtue of exciting in the person who drinks it love for him or her who administers it. Magical rites were used in their preparation, and they were freely employed in classic times. In many cases noxious drugs found a place among the ingredients. There is a legend (probably unfounded) that the death of Lucretius was due to the effects of a love-drink of this kind administered by his wife.

Phips, SIR WILLIAM (1651–94), American administrator, was born in Maine, and became sheriff of New England in 1687. Whilst Governor of Massachusetts (1692–94) he put an end to the persecution of reputed witches.

Phlebitis, inflammation of the coats of a vein. When the internal coat is affected, the blood in the vessel forms a clot or *thrombus*, and thrombosis and phlebitis are thus associated one with another. The symptoms of phlebitis are the presence of tenderness and reddening over the course of the vessel affected, and this is moreover marked out by the existence of what feels like a hard cord in the position of the vein. Phlebitis may be due to injury, to the extension of inflammation from the tissues surrounding the vein, to gout, and other causes. In suppurative phlebitis the cause of the mischief is a micro-organism. It occurs in connection with wounds which assume a septic condition, in acute necrosis, and in pyæmia.

Phlebotomy. [BLEEDING.]

Phloem. [BAST.]

Phlogiston. During the eighteenth century the whole theory of chemical reactions, more especially in relation to combustion, was founded upon the suppositious existence of an element known as *phlogiston*. All combustible materials were supposed to contain this substance, and the more they contained the more actively did they burn on ignition. During combustion the phlogiston escaped and a dephlogisticated product was left. By a slight extension it is seen that metals were supposed to consist of their calces—*i.e.* oxides—with the addition of phlogiston, and the reduction of a metallic oxide by carbon or other reducing agent was regarded as due to the combination of the phlogiston, so plentiful in the latter, with the calx. These views, enunciated first by Stahl, were held by a large number of distinguished chemists, as Black, Scheele, Cavendish, and Priestley, the two

latter of whom, it is noticeable, though firm adherents of the theory, contributed much to its overthrow. The fact that the calces weighed more than the metals from which they were produced was explained by the assertion that phlogiston was a "principle of levity." In this fact, however, lay the nucleus of the phlogistic downfall, although the establishment of the oxygen theory of combustion now held was only brought about after a long and arduous scientific struggle, and chiefly through the instrumentality of the great French chemist Lavoisier.

Phlox, a genus of North American plants, belonging to the order Polemoniaceæ, among the Gamopetalæ, cultivated for their showy flowers. These are generally borne in large panicles terminating erect, unbranched stems, and have their parts in whorls of five, and a broad salver-shaped corolla. They are mostly white, red, or purple, and hybridise freely.

Phocæna. [PORPOISE.]

Phocidæ. [SEAL.]

Phocion (402?-317 B.C.), an Athenian general and statesman. He studied under Plato and Xenocrates, from whom he may have derived his contempt for the Athenians and indifference as to the preservation of their republican institutions. Although he always advocated a peace policy, his services in the field were so valuable that he was forty-five times elected general. His success at Byzantium in 340 compelled Philip to withdraw from the Hellespont. He showed himself a consistent politician by adhering to Alexander the Great (who held him in high esteem) and endeavouring to check the struggle for independence known as the Lamian War (323-22). He supported Antipater's son Cassander against the Macedonian regent Polysperchon, and was given up by the latter to the Athenians, who put him to death.

Phocis, an ancient Greek state, lay N. of the Corinthian Gulf and W. of Bœotia. It contained Mount Parnassus and the rivers Cephissus and Plistus. It was mountainous and, except the valley of the Cephissus, unproductive. The state is said to have derived its name from its coloniser, Phocus, son of Ægeus. The people were industrious agriculturists, and proved their bravery in different wars. In the Peloponnesian War they were allies of Sparta.

Phœnicia was an ancient country on the coast of Syria, W. of Lebanon. Phœnicia proper consisted of a strip along the coast from Tyre to Sidon, 28 miles long by about one broad, but later it was much extended and formed a fertile district watered by numerous rivers flowing from Lebanon to the sea. The land is fit for cereals, fruits, and, in the uplands, timber, and there is some iron near Beyrout.

Phœnicians, a renowned Semitic people, whose original home is supposed to have been in the islands and round the shores of the Persian Gulf, whence they migrated in prehistoric times

to the head of the Mediterranean, between Asia Minor and Egypt. Here they founded Tyre, Sidon, and other flourishing marts, and over 3,000 years ago became the chief intermediaries of trade and intercourse between the eastern and western nations, and the great seafarers of antiquity. They founded numerous settlements, such as Utica, Carthage, and Cadiz on the Mediterranean seaboard and beyond the Straits, traded with the British Isles, introduced a knowledge of letters into Greece, circumnavigated Africa once, if not twice, and contended with Rome for universal empire. Their Semitic language is nearest allied to Hebrew, and was written in the oldest known alphabet, most probably derived from the hieratic and demotic phonograms of the Egyptian or Chaldæan hieroglyphics. Numerous inscriptions are still extant in this script, which is the direct or indirect source of nearly all current syllabic and alphabetic systems.

Pholadidæ, the family of bivalved mollusca of which *Pholas*, or the Piddock, is the type. The shell is gaping, is composed of very hard material, and is armed with strong ribs and teeth on the external surface: by means of these it excavates a vertical burrow in chalk, mud, and other soft rocks. The animal makes a series of half-turns in its burrow and thus wears away the matrix, the powder of which is washed out by a current of water. They are all marine shallow-water inhabitants, and range in time from the Lias onward.

Phonetics, literally, are the enunciation of the principles upon which the production of sound depends; but the term is generally applied to those principles which govern the production of articulate human speech. Attempts have been made to establish the fact that articulate speech obtains among animals other than men, but they have not resulted in any positive evidence of this. In one sense phonetics are a branch of physiology, since speech is the resultant of breathing processes modified by the conditions of the larynx, tongue, and mouth, and nasal spaces. Some have considered that speech so modifies some of these parts that an examination of them would go far to determining to what race, or at least to what group of languages, an individual belongs by descent. It is chiefly as an aid to philological discoveries that phonetics have a practical value. The term phonetic is also applied to a system of spelling the object of which is to reproduce in letters the exact sound of words, and this use of phonetics has many supporters, especially among those who have to do with shorthand. This mode of speech is illustrated by printed organs and magazines, whose repulsiveness to the eye goes far to render any wide spreading of the system unlikely.

Phonograph is an instrument for recording and reproducing sounds, originally devised by Edison. Sounds, being vibrations of the air, will, if produced near an elastic diaphragm, cause it to vibrate similarly. If the diaphragm be provided with a sharp but smooth point projecting from its centre, and if this point just touch a sheet of tin-foil supported in a suitable way and moved at right

angles to it, a series of indentations will be produced. When the diaphragm is moved towards the tinfoil it will make a small hollow, but will leave a little hill when it moves in the other direction. In this way the sheet of foil forms a record of the sounds. If the foil is again moved past the point, the latter will be pushed back and forth by the indentations, and as the diaphragm moves with the point it will be thrown into vibration and the original sounds will be more or less accurately reproduced. In the original instrument the foil was wrapped round a cylinder having on its surface a spiral groove and turning on an axle on which was cut a screw-thread of the same pitch as the spiral; this axle turned in a nut, so that the cylinder moved longitudinally while it was being turned. By this means the point on the diaphragm was always kept opposite the groove. If words were shouted into a mouthpiece attached to the diaphragm while the cylinder was rotated by clock-work, and if the cylinder were afterwards put back to its original position and again rotated, sounds were emitted which bore some resemblance to their original, so that if one had heard them spoken into the instrument one could generally recognise them. A much-improved instrument has more recently been made by Tainter and Edison, in which a cylinder of wax replaces the tinfoil, a groove of varying depth being cut on it by a sharp point shaped after the manner of a turning-tool. When the machine is required to talk, another diaphragm, provided with tubes for insertion in the ears, is put in position. The cylinder is rotated by an electric motor, and the details have been worked out with much care. By these improvements the articulation has been made very much better, but the volume of sound has been reduced. The original pattern produced plenty of sound, such as it was—it could, indeed, be heard by the whole of a small audience—but the new model requires tubes from the diaphragm to the ears. It is suggested by the inventors that the phonograph can be used as a means of correspondence, the wax cylinder being transmitted through the post; but it seems much more probable that it will continue to be interesting only as a scientific toy.

Phonolite, or CLINKSTONE, a compact, grey, semi-crystalline lava, consisting mainly of sanidine feldspar and nepheline, and named (from the Greek *phone*, “sound”) on account of the ringing sound it emits when struck with a hammer. The rock usually contains some hornblende and nosite, and is sometimes porphyritic. Its specific gravity is about 2.58. It is of Tertiary age, and occurs among the lavas of Auvergne and Bohemia. In thin slabs it is used for roofing.

Phoronis is the genus which forms the class Vermiformia, which used to be included as an aberrant group of Bryozoa and was even once regarded as one of the tube-dwelling worms. The group of tentacles around the mouth forming a true “lophophore,” however, shows its affinity to the Bryozoa. The animals live each in a leathery tube which are united in small colonies. The body cavity is an archicœle and in other ways the animal

is very primitive. The genus is marine, and lives on the British coast.

Phosphates. The phosphates are the salts of the phosphoric acids, being divided into *ortho*-, *pyro*-, and *meta*-phosphates, according as they are derived from the acids with corresponding prefixes, represented respectively by the formulæ H_3PO_4 , $H_4P_2O_7$, HPO_3 . The first acid is the most important, and is that meant usually by phosphoric acid. Its anhydride, P_2O_5 , is a white powder which absorbs water with great avidity, and is hence very useful for drying gases and liquids. The acid itself may be prepared by the action of nitric acid upon phosphorus, or from bone-ash by the action of sulphuric acid. It forms rhombic six-sided crystals, which are easily soluble in water. It forms three series of salts (ortho-phosphates), *i.e.* those in which 1, 2, or 3 atoms of hydrogen are replaced. They are recognised in solution by the yellow precipitate they give with silver solutions, and are employed in the chemical laboratory for the quantitative estimation of magnesium. The phosphates, chiefly in the form of the acid calcium salt, are very largely employed in agriculture. As phosphorus is an essential constituent of plants, and the supply is entirely drawn from the soil, unless phosphorus is added in the form of natural or artificial manures, the soil becomes exhausted and the crops deteriorate. Experimental farming, as at Rothamsted, has conclusively shown how marked is this influence of the proper addition of phosphorus (in a condition available for plant assimilation) upon the quality and quantity of the crops obtained.

Phosphatic Nodules are generally rounded and waterworn masses of animal, or of purelycretionary origin, containing a considerable percentage of phosphate of lime. [APATITE.] They vary considerably in different geological formations. In the Bala limestone, in the Ordovician of North Wales, they occur in a graphitic matrix, and contain 64 per cent. of phosphate. In rocks of similar age in Canada the nodules are believed to be coprolites (*q.v.*), as they certainly are, in part at least, in the Carboniferous shales of Scotland. These last are associated with bones and scales of large ganoid fish and contain those of smaller ones. Coprolites of fish and saurians are not uncommon in Secondary rocks, but do not occur together in any quantity. In Cretaceous rocks, such as the Lower Greensand of Bedfordshire and Cambridgeshire, the Gault, and the Upper Greensand, at several horizons and in various parts of England, beds of phosphatic nodules occur which consist largely of rolled fragments of ammonites and other fossils, derived in most cases from Upper Jurassic rocks as a beach deposit. Similarly, near the base of the Pliocene of Suffolk a bed occurs, erroneously called coprolitic, which consists of rolled and highly-phosphatised bones and teeth of sharks and mammals, possibly the result of the denudation of some of the Black Crag of Antwerp. With these rolled fossils are associated structureless masses, which are also phosphatic and would appear to have a purely chemical origin. It is suggested that these may have been originally mainly calcareous and that

they, in common with the derived fossils, have been phosphatised by replacement, the phosphoric acid from beds of decaying sea-weed being attracted by pre-existing traces of phosphorus, common in all organic rocks and remains.

Phosphor-bronze consists of bronze (q.v.) with which is combined a very small quantity of phosphorus. This addition favourably influences the quality of the metal to a marked extent. The alloy formed is paler than the original bronze, is malleable and ductile, and withstands a very great tensile stress. It is also suitable for castings, and resists the corrosive action of both water and the atmosphere far better than bronze itself.

Phosphorescence is the property which some substances—*e.g.* sulphides of barium, strontium, and calcium—exhibit of shining in the dark. The body really absorbs light which falls upon it from some source, and gives back this light again when the source is removed. White light is not necessary for the exhibition of this phenomenon, it being chiefly caused by the violet and ultra-violet rays. Becquerel's PHOSPHOROSCOPE has revealed the fact that a great number of bodies exhibit the property of phosphorescence, but only shine for an extremely short time after the light is removed. This instrument consists of two discs, joined one behind the other, each with four apertures, those of one disc being half-way between those of the other. The substance is placed between the two discs, the whole being kept in a dark cylinder and used in a dark room. Into a small hole at one end of the cylinder a beam of light is sent, and the eye is placed at a corresponding hole in the other end, the substance being in a line between the two holes. The discs are made to rotate, and in consequence of the alternation of the apertures in the two discs, the observer only sees the substance when it is not exposed to the light. If the body be at all phosphorescent, it will, after receiving light through one aperture, give out the light again a certain time after that aperture has passed on, and the speed of rotation can be so adjusted that the time during which the body imprisons its light is equal to an eighth part of the time of rotation. In that time one of the apertures of the other disc will have come opposite to the body, and so it will be seen by the observer. With this machine phosphorescence lasting only a ten-thousandth of a second can be detected. Ordinary phosphorus is luminous in the dark when rubbed, and this is the origin of the term phosphorescence. Animal phosphorescence is exhibited by both living and dead matter. In the case of the latter it is easy to show that it is due to the slow oxidation or combustion of the animal tissues or to the development of bacteria. It is most typically shown in the case of the minute marine organisms such as the bacteria which grow around decaying fish, etc., or the infusoria which live on the surface, such as the tiny *Noctiluca miliaris*. These are only phosphorescent when irritated, as by waves or other disturbance of the water. Many more specialised invertebrates are also phosphorescent, such as *e.g.* the Jellyfish, *Cyanea*, Sea-pens or *Pennatulidæ* as *Virgularia*,

Ascidians as *Salpa*, Starfish as the common *Asterias*, Ophiuroids as the Sand-stars, the Siphonophora as *Physalia*, Mollusca as *Pholas*, and worms such as *Nereis*. But some land animals possess the same property, *e.g.* the earthworm and the common English centipede (*Scolopendra electrica*). The insects afford many of the most interesting examples, such as the Glowworm (*Lampyrus noctiluca*), which is the male larva of a beetle, the Fireflies (*Elater*), the Hemipterous genus *Fulgora*, the moth *Noctua*, and some species of *Bombyx*, and the Mole Crickets. The cause of phosphorescence is still not fully explained; at one time it was thought to be due to slow combustion, similar to that which imparts phosphorescence to some inorganic bodies and some decaying animal matter. It is, however, now generally regarded as due to nervous energy; just as in the Torpedo or Electric Eel, nerve-power is transmuted into electricity, so in phosphorescent animals it turns into light.

Phosphoric Acid. [PHOSPHATES.]

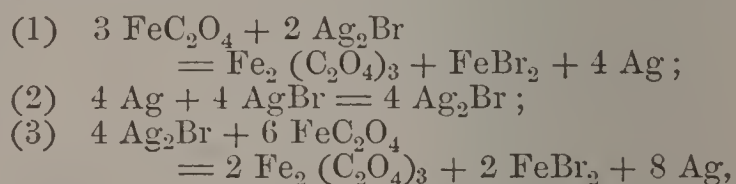
Phosphorus (P 31), a non-metallic element, which was first prepared about the year 1670 from urine. For a long time it was very costly and highly valued as a chemical curiosity, being exhibited to Charles II. and other European monarchs. It does not exist in nature in a free state. Combined with other substances, however, it enters into the composition of many rocks and minerals, while it is also an invariable constituent of the human body, being present chiefly in the bones and nervous tissue. Plants contain it as an essential constituent, and it is hence a necessary ingredient of fertile soils. It is chiefly prepared from bone-ash (q.v.), being obtained by the reduction of calcium metaphosphate by means of carbon and silica. The manufacture is somewhat difficult and dangerous, owing to the extreme ease with which the element ignites, burning very readily in air with the production of dense white fumes. *Ordinary* phosphorus is a waxy-looking solid of specific gravity 1.8, melting at about 44° C. It oxidises if exposed to the air, and must therefore be kept under water. It appears luminous in the dark if moist, the luminosity being due to a slow oxidation. It has a crystalline nature, forming almost colourless octahedral crystals. It also exists in another *amorphous* variety, which possesses a red colour, and is heavier and harder than the ordinary variety, from which it may be obtained by heating to about 240° C. in the absence of air. This form does not oxidise when exposed to the air, and further differs by being non-poisonous and insoluble in the solvents of the crystalline phosphorus. By strongly heating with lead also the element may be obtained as metallic-looking crystals of specific gravity 2.34. Phosphorus is very largely employed in the chemical laboratory and in various chemical manufacturing processes, but by far the greatest quantity is used in the manufacture of lucifer-matches. With oxygen it forms two compounds of composition P_2O_3 and P_2O_5 , both of which are anhydrides of acids. With hydrogen it forms some interesting compounds, one of which possesses the property of spontaneous

inflammability in air; while with chlorine it unites directly, forming chlorides which, together with the other halogen compounds, are largely employed for chemical purposes.

Photius (d. 891 A.D.), Patriarch of Constantinople, was descended from a wealthy and noble Byzantine family. He became a favourite of the Cæsar Bardas, uncle of the Emperor Michael III., and through his influence was raised to the patriarchate in 857, passing in the five previous days through all the preliminary orders. His opponent, Ignatius, was supported by the Pope Nicolas I., and a breach ensued between the two Churches, Photius raising difficulties concerning matters of doctrine and discipline, and (867) calling together a Council which excommunicated Nicolas. The murder of Michael III. and accession of Basilus the Macedonian were followed by the recall of Ignatius and the banishment of Photius; but the latter afterwards became reconciled to his old enemy, and succeeded him as Patriarch (878). He was again deposed and banished, however, in 886, and ended his days in an Armenian monastery. His *Myriobiblion seu Bibliotheca* is a very valuable work, containing the names and short accounts of some 280 authors with critical remarks.

Photography. A photograph is generally accepted as meaning a picture or reproduction, which has been produced by the influence of light upon certain prepared surfaces, and the science treating of the laws by which this action is governed and the nature of the changes it produces, constitutes the science of photography. The history of photography may be said to commence in 1813, when Niepce prepared prints by the process known as daguerreotype (q.v.), although the nucleus of a photograph existed when, in 1556, it was observed that chloride of silver darkened when exposed to sunlight. In 1839, Fox Talbot obtained prints by means of paper sensitised by a silver solution, and shortly afterwards further improved his methods. In 1848, glass coated with albumen was first employed as recipient of the sensitising solution, the albumen being shortly afterwards replaced by collodion, which in turn gave way to gelatine as the coating for glass plates in 1871, when plates were used corresponding to those now employed. Although many photographic processes are now employed, almost all depend firstly upon the production of a "negative"—i.e. a transparent image in which the light portions of the object photographed are represented by dark in the negative and *vice versa*. For the production of such a negative the prepared plate or film is placed in the dark slide in the camera focussed upon the object to be photographed. [CAMERA.] The image of the object is thus formed upon the plate. The *exposure* varies from a very small fraction of a second to some hours, according to the nature of the subject, the intensity of the light, and the rapidity of the plates. Under the influence of the light the silver bromide on the emulsion of the plate [GELATINO-BROMIDE] undergoes a change such that when it is treated with a reducing agent known as a *developer*, those parts where the light

has acted, darken owing to the separation of finely-divided metallic silver. When the development is complete, or has gone on sufficiently far, the plate is taken out of the developer, washed, and treated with a *fixing* solution—usually hyposulphite of soda—by means of which the unaltered silver bromide is dissolved out of the emulsion, while the darkened image of silver is left. [FIXING.] The plate is hence no longer sensitive to light, to which it may be exposed without alteration. It should, however, be washed thoroughly to get rid of the fixing agent, after which it is dried and is ready for future use. The substance most used for developers in this country is probably *pyrogallie acid* (q.v.), dissolved in water with the addition of excess of sodium sulphite and some alkali and potassium bromide (9 grains pyro., 6 grains sodium carbonate, 3 grains potassium bromide, 50 grains sodium sulphite, in 3 ozs. water). *Ferrous oxalate*, *hydroquinone*, and a number of compounds known by such names as *rodinol*, *metol*, *amidol*, *eikonogen*, etc., are also frequently employed. The explanation usually given of their action is that by the influence of the light a sub-bromide of silver, Ag_2Br , is formed which gets reduced to the metallic state by the developer. The silver thus formed reacts further, with more silver bromide, to again form sub-bromide, which again undergoes reduction, so that the action becomes cumulative. Thus, in case of ferrous oxalate:—



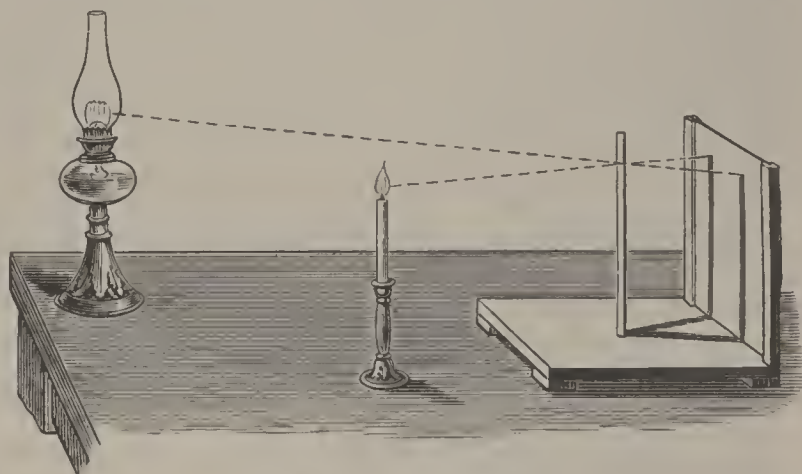
etc. There are, however, many difficulties in this simple explanation of the photographic action. It is interesting to observe that by the use of some substances with the developer, *e.g.* thiocarbimide, the developed image is of a white instead of a black colour, so that a positive is produced at once, the same sort of effect often taking place if the exposure has been much too great. Owing to this, also, plates that are *over-exposed*, unless carefully developed, frequently show *flatness*—i.e. an insufficient contrast between the light and shade; while if under-exposed, the image may not be sufficiently dense to yield good prints. In such a case the negative is improved by *intensification* (q.v.). From the negative a positive image or print may be taken in various ways. The ordinary silver prints of the professional are produced by means of paper sensitised by a coating of albumen containing in it silver nitrate and other salts. A piece of this paper is laid flat upon the film side of the negative in a printing frame and exposed to the action of light. No development is necessary, the paper becoming darkened in those places where the light acts. When sufficiently printed, the paper is taken out, and at the time, or later, is placed in a *toning* bath consisting of a dilute solution of gold chloride with borax or other salts. By this bath the image becomes of a more pleasing and softer colour than when taken from the frame. It is then *fixed* in the same manner as the negative, washed well and

dried, and, if required, mounted, starch-paste being the favourite mountant employed. Lately, however, papers with a gelatine emulsion instead of albumen have been becoming more popular, and, amongst amateurs at least, who usually work on less restricted lines than professionals, seem to be superseding the older paper. A large number of more artistic and permanent processes are also employed amongst photographers, for accounts of which articles on CARBON PRINTING, PLATINOTYPE, COLLOTYPE, etc., may be consulted. In its scientific applications, photography has of late years been very greatly extended—most notably, perhaps, in astronomy, where by its means reproductions of stars, nebulae, etc., quite indistinguishable to the eye, are obtainable, while phenomena visible during eclipses and other short-duration phenomena can be examined at length. Within late years, also, photographs taken in exceedingly short time, as those of flying bullets, etc., have commanded much interest; while in bacteriology the application of photography has been productive of a great increase in knowledge concerning bacteria and other micro-organisms. [HAND-CAMERAS, DAGUERRETYPE, FERROTYPE, and other photographic articles.]

Photogravure is the production of an etching upon a copper-plate from photographic negatives, and is effected by a combination of light, chemical action, and hand-work. Of the different processes the most usual is that called "Klic's method." A coppered plate is dusted with asphalt, which is partially melted by the application of heat. A negative carbon print is then transferred to it, and the design is eaten in by a solution of perchloride of iron (strong for the thin parts, and weak for the thick parts). Another process is the Collotype method. In this case the impression is taken upon bichromatised gelatine spread upon glass, and this plate is then washed and used as a printing-block.

Photometry is that part of the science of optics which deals with the measurement of the relative amounts of light from different sources. The methods by which this result is obtained are mostly based upon the fact that it is easy to approximately detect by the eye when two similar surfaces are equally illuminated. The illumination on a given area of a screen from any light is inversely proportional to the square of the distance between the light and the screen, and this is the foundation of all photometric calculations. Rumford's photometer consists of a screen with a cylindrical rod placed a short distance away. Each of the two lights which are to be compared throws a shadow of this rod on the screen, and the lights are moved until the two shadows are equally illuminated. The ratio of the two lights is obtained by calculating the distances of each from the screen, and taking the ratio of the squares; naturally the brighter light is the farther away. Bunsen's photometer consists of a screen made of two parts, the one being more transparent than the other. The old form was a paper screen with a grease spot. The two lights are placed on opposite sides and moved till the spot and rest of the screen

look equally bright. When the one side of the screen is more illuminated than the other, the grease spot will look brighter than the rest of the screen when viewed from the darker side, and it will look darker when viewed from the other side. The lights are therefore moved till this difference ceases to exist. The grease spot, however, was found to be rather unsatisfactory; so, instead of this, a screen consisting partly of one and partly of two thicknesses of crown glass has been used. When two



RUMFORD'S PHOTOMETER.

lights of very different illuminating powers are to be compared, it is often impossible to move the brighter light far enough away from the screen. A lens is then employed to form an image of the bright light, and the light on the screen is produced by this image. Since this brightness of the image, is to the brightness of the original light in the ratio of the square of their distances from the lens, this gives a means of comparing two lights not so different in intensity. If the image and light are at distances I and L from the lens, their illuminating powers are in the ratio $\frac{I^2}{L^2}$. If the image at a

distance A from the screen gives the same result as the standard light at a distance s , then the ratio between the bright light and the standard is $\frac{A^2 L^2}{s^2 I^2}$.

Many other photometers have been introduced in recent years with the special object of testing the illuminating power of arc lamps. It is usual to give the illuminating power of any source in terms of the standard candle, the standard candle fixed by Act of Parliament being made of spermaceti, weighing $\frac{1}{6}$ of a lb., and burning 120 grains of material per hour. An argand gas-burner is, however, generally held as the official test-burner for gas.

Photophobia, intolerance of light, is a distressing symptom in some forms of ocular mischief, notably in ulcerations of the cornea. Cocaine is of great service in the treatment of the condition.

Photophone. It was discovered by Willoughby Smith in 1875 that when the metal selenium forms part of a closed circuit, its resistance changes with varying illumination. Vitreous selenium has an enormously high resistance, but in its crystalline condition its conductivity is much increased, and it is then most influenced by light. Professor Adams

showed that the change of resistance was proportional to the square root of the illumination. Upon this property depends the action of the photophone, which may be said to transmit sound along a beam of light. The person whose speech is to be transmitted causes, by the vibrations of his voice, a light mirror to be thrown into motion. The mirror reflects a beam of light to a distance, where it falls upon a piece of selenium connected in circuit with a battery and telephone. The mirror, in consequence of its vibrations, sends a varying amount of light to the selenium. Hence the resistance of the selenium is altered, and the variation of the current which is thereby caused reproduces the sounds in the telephone. The beam of light is originally sent through a lens, at whose focus the light mirror is placed; at the receiving end it is reflected from a parabolic mirror on to the selenium which is placed at the focus. In this way, greater variation of the light is obtained for the same amount of vibration. It has also been found that selenium will give out a sound without the aid of battery and telephone when a beam of intermittent light is thrown upon it. Later experiments have shown that selenium is not alone in this property. Tellurium, antimony, gold, silver, carbon, parchment, hard rubber, and some kinds of wood are also electrically sensitive to light.

Photosphere is an envelope surrounding the nucleus of the sun, and forms the visible limit of the sun's disc. According to Wilson's theory, the nucleus or main body of the sun was supposed to be solid and cool, while the photosphere was self-luminous and consisted of incandescent gas. Kirchhoff considered the nucleus to be incandescent and the photosphere to be liquid. Arago's experiments on the polarisation of the sun's light supported the theory of a gaseous photosphere. M. Page considered this envelope to be a simple consequence of cooling, and regarded it as the limit separating the intense heat of the nucleus from the cold of space. The spectroscope has proved that the nucleus must be liquid or solid, not gaseous, since it glows with an intense white light, and the dark lines in the spectrum are due to the cooler vaporous photosphere. Since the lines prove the presence of magnesium, sodium, iron, copper, in a state of gas, it is obvious that the photosphere is not by any means at a low temperature, but only cooler than the nucleus itself. The dark centres of sun spots give spectra the same as those of the photosphere, except that the dark lines are broader and more intense; hence it has been assumed that these spot centres are only compressed portions of the photosphere and consist of relatively cool vapours at a lower level.

Phragmacone, the conical cavity at the upper end of the shell or guard of a Belemnite (q.v.). It is divided into a series of chambers by thin horizontal plates or septa; but the chambers are connected by a tube or siphuncle.

Phragmophora, a name allied to the group of Cephalopoda (q.v.) including those which, like the Belemnite (q.v.), possess a hard internal skeleton with a chambered cavity at one end. The group is

now extinct, and is mainly characteristic of the Mesozoic period.

Phrenology, a pseudo-science which professes to locate all the mental processes, and to read character from the brain-case or skull. It rests upon two assumptions:—First, that every propensity and inclination of human nature has its own place in the brain, such spot being increased in material development by the exercise of such function; and that these internal developments register themselves by corresponding developments of the external skull. The idea was first started by Gall in 1796, and was carried on by Spurzheim in 1800. In 1814 the latter lectured in England and at Edinburgh, where he found a doughty opponent in Sir William Hamilton, who, after an examination of numerous skulls, established the fact that the external skull is no safe criterion of the size or development of the brain within, and was able to cite cases in which disease had destroyed much of the brain material without any apparent loss or change in the mental characteristics. The medical theory that different functions are exercised by different portions of the brain is quite distinct from the doctrines of phrenologists.

Phrygia was in Persian times a central province of Asia Minor. At an earlier period the name Phrygians was applied to the Trojans, Lydians, Mysians, and other primitive inhabitants of Asia Minor. Later the country was divided into Greater and Lesser Phrygia, and Phrygia Epictetos. Although their music was martial the people seem to have occupied themselves with grazing and agriculture. Much of their history was mythical, and the names of Gordius and Midas often occur among their list of sovereigns. Phrygia was long ruled by Persia, but when the Persian line ended with Adrastus in 560 B.C., it became a province of Lydia, to fall again into Persian hands, and later into those of the Romans.

Phryne, a celebrated Greek courtesan, who lived at Athens in the 4th century B.C. She sat as a model for the Cnidian Aphrodite of Praxiteles, who was one of her lovers.

Phrynichus. (1) A tragic poet, who occupies a position midway between Thespis (q.v.) and Æschylus (q.v.) in the development of the Attic drama. The Athenians were so much affected by his play, the *Capture of Miletus*, acted soon after the capture of that city by the Persians (494 B.C.), that they fined the poet 1,000 drachms and forbade its reproduction on the stage. (2) A poet of the old Attic comedy, contemporary with Aristophanes. (3) A grammarian of the 2nd century A.D., born in Bithynia. His chief work was his *Sophistike Paraskeue*, containing a collection of Attic words and phrases, with rules as to their proper use.

Phthisis. [CONSUMPTION.]

Phylactery (Greek, *phylakter*, "a protection") signifies generally an amulet. Among the Jews it is applied to certain strips of parchment inscribed with passages of Scripture and bound upon the forehead, left arm, and other parts of the

body. Among them it had something of the nature of an amulet or charm. In Christian times the name was sometimes applied to a reliquary.

Phylactolæmata, a division of the moss-like animals known as Bryozoa. It belongs to the sub-class Ectoprocta (q.v.), which includes those that have the anus opening outside the ring of tentacles around the mouth. The characters that distinguish this division from its ally the Gymnolæmata are that the tentacles (or lophophore) are arranged in a horseshoe-shaped line and that the mouth is overhung by a small plate or epistome. The division is a very small one, and all the members are inhabitants of fresh water. There are in England 15 species belonging to five genera; *Cristatella*, *Lophopus* and *Plumatella* are the three best-known genera.

Phyllopoda, an order of Crustacea belonging to the sub-class which includes the small, simply-organised members of the class, and is known as the Entomostraca (q.v.). The characters that distinguish this from the other three orders (viz. Ostracoda, Copepoda and Cirripedia) are that the body is elongated and generally divided into a number of distinct divisions or segments, that there is usually a rounded, shield-shaped or bivalved shell protecting the head and thorax, and several pairs of swimming feet. The order is divided into two sub-orders, known as the Cladocera, including small forms with a bivalved shell, as *e.g.* the water-flea, or *Daphnia*, and the Branchiopoda. The latter are larger, have numerous pairs of swimming-feet. Most of the Phyllopods live in fresh or brackish water; thus *Daphnia* and *Apus* are fresh-water, the *Artemia* or the "Brine-shrimps" occur in salt lakes and lagoons. Many fossils have been referred to this order. This is unquestionably correct with the numerous species of *Estheria*, but with the more interesting fossils from the Skiddaw Slates (Upper Cambrian) such as *Hymenocaris*, it is more doubtful; these are probably to be referred to the Leptostraca (q.v.).

Phyllotaxis, the arrangement of leaves on the stem, is of two chief kinds, two or more leaves springing on different sides of the stem from each node, or one leaf only doing so. The first case is called *whorled*, the second *scattered*, or, less accurately, *alternate*. If whorled leaves spring two from a node, they are termed *opposite*. The leaves in each whorl commonly stand over the spaces between those in the next whorl below, or *decussate*. Thus opposite leaves are commonly in four vertical rows, and if one pair point east and west, the next will be north and south, and so on, as in the Mint tribe (*Labiatae*), in which this arrangement is commonly accompanied by a square stem. So, too, in juniper, where there are three leaves in each whorl, there are six vertical rows, or *orthostichies*, as they are termed. Scattered leaves are variously, but always spirally, arranged. In grasses, for instance, the third leaf, counting from any one, is vertically over the first—*i.e.* there are two *orthostichies*, so this arrangement is termed *distichous* or, strictly, *alternate*. We can trace a spiral line, the

genetic spiral, passing through each leaf in succession; and in this case this spiral will complete one turn round the stem in passing through a *cycle*—*i.e.* from any leaf to the next vertically over it—and in so doing will pass through two leaves, or from leaf one to leaf three. If this be projected on a ground plan, the successive nodes represented by concentric circles, and the *orthostichies* by radii, we shall find any two successive leaves separated by an *angular divergence* of 180° or half of a circle; so this arrangement is also termed the one-half arrangement. In sedges, on the other hand, the fourth leaf is over the first; there are three *orthostichies*, and often a triangular stem; the genetic spiral makes one turn, and passes through three leaves in a cycle; and the angular divergence is 120° or $\frac{1}{3}$ of a circle. This arrangement is called *tristichous*, or the $\frac{1}{3}$ arrangement. In most of the rose and oak tribe the arrangement is *pentastichous*, or $\frac{2}{5}$, there being five *orthostichies*, the angular divergence is 144° or $\frac{2}{5}$ of a circle, and the genetic spiral passes through five leaves in a cycle, and travels twice round the stem in so doing. These arrangements, $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{2}{5}$ form a mathematical series, the other terms of which $\frac{3}{8}$, $\frac{5}{13}$, $\frac{8}{21}$, etc. also occur, but chiefly in the close spirals of the scales of fir-cones, which are more difficult to decipher. Other arrangements, not in this series, occur; but rarely.

Phylogeny is the science that deals with the history of the development of an organism from its original ancestors. Thus to trace birds back to a reptilian stock, this through a yet earlier amphibian type to an animal without a vertebral column but only a dorsal chord, and thus back to the invertebrata, is to trace the phylogeny of birds. The two principal methods by which this study is carried on are by palæontology or the study of the actual shells or skeletons of extinct animals, and by embryology. The latter is of value, as it is thought that the actual history of the development of an individual (or ontogeny) is a summary of the life-history of its race; or, as it is technically expressed, ontogeny is a summary of phylogeny. This is no doubt correct in the main, but the ontogeny has been so much altered by the development of structures used only for the attachment or nourishment of the embryo, that it must not be too literally accepted. Thus in the larva of the Sea-urchin a series of calcareous rods has been developed forming an easel-like skeleton, whence it is known as a Pluteus. These have been merely secondarily acquired for the support of the larval appendages, and it would be quite erroneous to conclude that a former ancestor of the Sea-urchin resembled the Pluteus stage.

Phylum, one of the main divisions of the Animal Kingdom (q.v.).

Physalia, or the PORTUGUESE MAN-OF-WAR, is an Hydrozoan and the type of the Physalidæ, a sub-order of the Siphonophora (q.v.). The body consists of a large float or pneumatophore, which is bluntly spindle-shaped in form and little less than a foot in length; from this hangs down a series of tentacles and appendages, but these do not include

either nectocalyces or hydrophyllia. It lives on the surfaces of tropical seas, but stray specimens occasionally float into British waters. When touched they sting like a nettle.

Physical Geography. [GEOGRAPHY, PHYSICAL.]

Physics, in its widest meaning, may be defined as knowledge of the order of nature; and the constancy of this order, proved by experience in every one of Nature's manifestations, is the foundation of all science. In this sense physics should deal with all natural phenomena which have been reduced to scientific form; but gradually there has arisen a division of the subject into natural science and physical science. The former deals with organised bodies and the development of living things; while the latter treats primarily of phenomena in things without life, but continues its investigations among living things when it is seen that the phenomena in question follow the same laws as those applied to unorganised bodies. On the other hand, physics differs from the abstract sciences included in pure mathematics; for the latter is founded upon exact definitions, theorems and laws following each other with complete accuracy and independently of external causes, while such perfect accuracy is impossible in physics, since its laws are founded upon experimental inquiry, and hence liable to errors of observation and measurement. Clerk Maxwell has divided physics into two main groups:—

- I. The fundamental science of dynamics.
- II. The secondary physical sciences, which in their elementary stage are concerned with the deduction of laws founded on experiment and observation of phenomena, with the application of such laws to more complicated varieties of the phenomena; and in their advanced stage are concerned with attempts to show that these laws are the outcome of the dynamical relations of a certain connected system; and, further, they aim at a discovery of the *nature* of this dynamical system.

According to this definition, very few sciences have got beyond the "elementary" stage, and those which have proceeded farther are only at the lowest of the dynamical stages, of which there may be any number, each rising above the preceding.

Dynamics splits up into two groups—dynamics of a particle and dynamics of a system. Both can be divided into—

- (1) Kinematics, which deals with motion pure and simple, without any inquiry as to its cause.
- (2) Statics, the theory of equilibrium or the balancing of forces so that no motion takes place, which deals with the conditions which must be satisfied so that a body may remain at rest.
- (3) Kinetics, or the study of cause and effect as applied to motion, the amount of motion being found to be proportional to the acting force.
- (4) Energetics, a name given by Clerk Maxwell to the investigation of the forces acting between two bodies and the conditions under which energy is transferred from one to the other.

The dynamics of a system is of enormous importance, since all natural phenomena arise from the actions and reactions between parts of some system. The system may be rigid or fluid, the latter giving rise to the branches of dynamics known as hydrostatics and hydrodynamics as well as those branches which deal with fluid motion and internal forces.

Dynamics of a system includes, finally, dynamics of an elastic or of a viscous body.

The secondary sciences are divided by Clerk Maxwell into four main divisions:—(1) Theory of gravitation; (2) theory of the action of pressure and heat in changing the dimension and state of bodies; (3) the theory of radiance; (4) electricity and magnetism. The theory of gravitation is applied to the study of the motions of falling bodies and their weight, and is the basis of physical astronomy, affording a complete explanation of the movements of the heavenly bodies. The theory of the action of pressure and heat deals with—

- (1) The three physical states:
 - (a) Solids, their elasticity, viscosity, plasticity, tenacity.
 - (b) Liquids, their elasticity, viscosity, surface tension, cohesion.
 - (c) Gases, their elasticity, viscosity, adhesion.
- (2) Effects of a rise in temperature on a body; alteration in size and shape or change of state.
- (3) Thermometry or measurement of temperature.
- (4) Calorimetry or measurement of the amount of heat in a body, its thermal capacity and latent heat.
- (5) Thermodynamics, heat as form of energy, transformation of work into heat and heat into work, Carnot's cycle.
- (6) Dissipation of energy by friction, conduction, or the actual removal of high-temperature heat by the scattering of hot particles of matter.
- (7) The propagation of sound, vibrations of strings, rods, plates, and membranes.

The theory of radiance includes the whole science of light and the investigation of radiant heat. Under this head are to be considered:—

- (1) Geometrical optics, reflection and refraction; mirrors, lenses, optical instruments, such as telescopes, microscopes.
- (2) Velocity of light.
- (3) The spectrum, the visible and invisible part; radiant heat; the ultra-violet and chemically-active rays; fluorescence.
- (4) Interference, diffraction, colours of thin plates, Newton's rings.
- (5) The wave theory of light, measurement of wave-lengths.
- (6) Polarisation.
- (7) Radiation from a hot body, measurement of its energy; Prevost's theory of exchanges; rate of cooling.
- (8) The theory of the three primary colours.

Electricity and magnetism are divided into—

- (1) Electrostatics, theory of potential, electrometers.
- (2) Electrokinematics, the distribution of currents in conductors, chemical action in a battery, electrolysis.
- (3) Magnetism, magnetic induction, terrestrial magnetism and its distribution, compasses.
- (4) Electromagnetism, the relation between electric currents and magnetism, the law of the electromagnet.
- (5) Electrodynamics.
- (6) Electro-optics and magneto-optics, rotation of the plane of polarisation of a ray of light, electromagnetic theory of light.

These divisions differ somewhat from those usually followed, but it is a difference in arrangement only. For actual treatment of the sciences the usual arrangement is found more convenient. Although this science of matter and energy should naturally include chemistry, yet the latter is so vast in itself that it takes up a distinct position. That physics and chemistry are nearly allied is shown by the extent to which they overlap in that branch of science known as physical chemistry.

Physiognomy (literally "knowledge of nature") is the practice of judging from the features

the character of a man. Aristotle discovered animal likenesses in men, and concluded that men might resemble in character the animal they resembled in feature. Della Porta followed out the same idea in 1586, and it was more largely developed by Le Brun in the 17th century. Lavater endeavoured, with indifferent success, to make it into a science.

Physiography, signifying etymologically a description of Nature, was originally used for that department of geology (q.v.) which deals with the origin of existing surface features—*i.e.* the science of landscape. In 1869 Professor Huxley “borrowed the title” for a course of lectures on physical geography treated as “the propædæutic of natural knowledge,” as Kant termed it, or as “an introduction to the study of Nature.” These were published in 1877, and in the previous year the Science and Art Department substituted Physiography for Physical Geography in their examinations. Their conception of the subject includes the elementary properties of matter and the forces of Nature, or the elements of chemistry and physics; the nature of the earth’s crust, or the elements of geology; the leading characteristics of the sea and the atmosphere, or the elements of hydrography and meteorology; the relation of the earth to other heavenly bodies, or mathematical geography (q.v.); the constitution of the sun and other stars as revealed by spectrum analysis; and the evidence as to the nebular hypothesis, or the main conclusions of modern astronomy.

Physiology is the science which deals with the functions of living tissues. The study of the structure of such tissues is the subject-matter of *Histology* (q.v.), and their chemical constitution is dealt with by that branch of physiological science known as chemical physiology. Physiology proper is concerned with the functions of the blood and circulatory organs, of digestive, respiratory, secretory, and excretory organs, and those of muscle and nerve. To these must be added the organs of special sense and the subject of reproduction. [BLOOD, HEART, DIGESTION, MUSCLE, NERVE, etc.]

Physiology, VEGETABLE, the science of the functions of living plants, is yet in its infancy. It might be divided, as are the functions themselves, into the physiology of vegetation (*i.e.* nutrition and growth) and that of reproduction, but has been generally treated of late rather as a department of general physics, the action of the various forces of Nature upon plants and the reaction of the plants in modifying these forces having been considered in succession. The physiology of vegetation is concerned firstly with the food of plants, its elements, their sources, how they are taken in, and how they are utilised by the plant. The food of plants is ascertained by chemical analysis and by experiments in water-culture (q.v.) as to which ingredients are essential. Plants consist largely of water, which, with various saline substances in dilute solution, is taken in normally by the higher plants from the soil by their roots. Of their dried substance the greater part is carbon, taken in as carbon dioxide from the air by the leaves and other

green parts. [ASSIMILATION.] The utilisation of food-substances within the plant, as in the formation of sugars, starch, protoplasm and cellulose, and, still more, later metabolism (q.v.), are subjects of which as yet we know very little. In addition to the matter taken in by the plant, we have here to consider the energy it requires, the minimum, optimum, and maximum heat necessary for assimilation or the various metabolic processes, and the effects of light, electricity, etc. Light is generally essential to assimilation, but not to metabolism. Respiration (q.v.) may be considered as a process subsidiary to assimilation and transpiration (q.v.) and the course taken by water in the plant as part of the metabolic processes. Respiration is now considered as an identical function in every living unit of protoplasm connected with its anabolism and katabolism. Transpiration in the higher plants is performed by means of the stomata (q.v.) and lenticels, and the main course of water in the same plants is the cavities (lumina) of the vascular elements of the young wood. As one of the main results of nutrition, we have next to study the physiology of growth—growth in length and growth in thickness—and here we are largely concerned with the action of various external agencies as stimuli or the reverse, or as affecting the direction of growth. Speaking generally, light retards growth. Questions of symmetry inducing *heterauxesis*, or inequality of growth, and of consequent nutation and torsion, arise here, as well as those of geotropism (q.v.), heliotropism (q.v.), etc. Reproduction has been described as discontinuous growth, but this very discontinuity marks the great physiological opposition that exists between the vegetative and the reproductive functions; and, though the various methods of *vegetative reproduction*, by gemmæ, bulbils, offsets, cuttings, etc., are but slightly distinguished from mere growth, the sexual process opens up an entirely distinct series of problems, such as those of alternation of generations (q.v.), cross-fertilisation, heredity, and hybridism. These are but the chief topics of vegetable physiology. The formation of special secretions, the mechanical relations of resistant structures to strains, irritability, and other movements, and the means adopted for the dispersal of seed, are mainly subsidiary either to nutrition or to reproduction.

Physophoridæ, a sub-order of Hydrozoa belonging to the order Siphonophora (q.v.), including those with a flask-shaped float or pneumatophore, and with two or more rows of the modified individual polypes forming the structures known as nectocalyces, hydrophyllia, and hydrocysts. In the most typical genus *Physophora* these are borne on a long stem, but there are no hydrophyllia. The members of the group are all marine, and live swimming on the surface of the sea, far from land, in tropical and sub-tropical regions. No fossil representatives are known.

Piacenza (Latin, *Placentia*), capital of the province of the same name, is an Italian town, situate on the right bank of the Po, near its confluence with the Trebbia, in a fertile plain half-way

between Parma and Milan. It is now, as it was of old, of military importance. The chief buildings are the cathedral of the 13th and following centuries, the 13th-century town-hall, the Palazzo Farnese, and some fine churches containing good paintings. Chief industries are the manufacture of woollens, cottons, stockings, hats, leather, silk-spinning, paper-making. Gregory X. was born here.

Pia Mater. [BRAIN.]

Pianoforte, a musical instrument which in its simplest form may be described as a dulcimer fitted with keys. It succeeded in point of time the harpsichord, from which it differs in the fact that the sounds may be modified in intensity. Hence its name, which means "soft-loud." The construction of the piano is at the present day so familiar to



PIANOFORTE.

(Designed by T. G. Jackson, A.R.A.)

everyone that it is needless to describe it beyond saying that the keys when struck set in motion levers which cause the hammers to strike the one, two, or three strings that produce the notes, that intensity is produced by the action of a pedal which raises the dampers, and the soft effect by a pedal which shifts the action so that the hammer strikes only one or two wires instead of three, as the case may be. The two principal varieties of piano are the Grand, in which the strings are placed horizontally, and the Upright, in which they are arranged vertically. Fresh modifications and varieties of these and improvements in details are constantly being introduced, and the names of Erard, Collard, and Broadwood stand high for the quality of their instruments. The piano, which was introduced into England towards the end of the 18th century, is said to have been manufactured by Cristofori, of Padua, in 1710. In 1716 a Frenchman produced three models, and he was followed in 1721 by the German manufacturer Schröter.

Piaroas, South American aborigines, whose territory lies on both banks of the Orinoco between San Fernando de Atabapo and the Sipapo confluence, Venezuela; a few are also met in the Sipapo

Valley, and about the head-waters of the Orinoco. They are a timid, superstitious people, carefully avoiding all the settled districts and keeping entirely to the recesses of their trackless woodlands. They build large and carefully constructed conic houses 30 to 40 feet in diameter, 20 to 25 feet high, and roofed with palm-thatch which resists the torrential tropical rains for years. The Piaroas, who are a stout, vigorous people, of very dark brown complexion, believe in a kind of metempsychosis, according to which all members of the tribe descend from tapirs and after death revert to the tapir state, while other peoples are similarly related to other animals. (Crevaux, Chaffanjon.)

Piastre ("thin plate of metal") was the name applied to the Spanish dollar of the 17th century, which was also called *peso* and had a value of about 4s. 4d. of English money. The Italians adopted it in imitation of Spain. In South America the name *peso* is still retained. The name *piastre* is now used by other nations to denote the unit of Turkish currency, and it is worth in Turkey 2d., in Egypt 2½d.

Piccolomini, a distinguished Italian family which reckoned among its members the scholarly Pope Pius II. (q.v.). OTTAVIO PICCOLOMINI (1599–1656), Duke of Amalfi, passed from the Spanish service into that of the Emperor Ferdinand II., and played a distinguished part in the Thirty Years' War, contributing to the victory of Nördlingen (1634), expelling the French from the Netherlands (1635), and saving Austria from invasion by a Swedish host under Banér (1640). After a defeat by Torstenson in Silesia (1642), he re-entered the Spanish service, and was appointed commander-in-chief in the Netherlands. He died at Vienna.

Pichegru, CHARLES (1761–1804), French general, was the son of a labourer of Arbois in the Jura. He entered an artillery regiment in 1783, and, showing exceptional capacity on the outbreak of the Revolution, was placed in command of the Army of the Rhine and reconquered Alsace (1793). Receiving the command of the Army of the North in February, 1794, he within a year conducted three brilliant campaigns, the first of which was terminated by his victory over the Austrians at Fleurus (June 27th), the third by his entry into Amsterdam (January, 1795) and occupation of the whole of Holland. He was recalled to Paris two months later, and crushed a rising of *sans-culottes* against the Convention. He now returned to the Rhine; but, in spite of his great popularity, he began to intrigue for the return of the Bourbons. His treachery became known, and in December, 1795, he was superseded by Moreau. As member and afterwards president of the Council of Five Hundred, he still endeavoured to promote the interests of the Bourbons, and was in consequence deported to Cayenne (1797). He escaped to England and there met Georges Cadoudal, whom he joined in his abortive attempt to assassinate Napoleon. Betrayed by a friend, Pichegru was imprisoned in the Temple, where one morning he was found strangled. His death was probably self-inflicted, but at the time it was attributed by the Royalists to Napoleon.

Pico della Mirandola, GIOVANNI (1463-94), was the youngest son of Giovanni Francesco Pico, Prince of Mirandola (a small territory afterwards incorporated in the Modenese). In his childhood he displayed marvellous precocity, and the narrow round of instruction in the university of Bologna drove him forth in disgust to seek out new paths of learning as a wandering scholar in Italy and France. Arriving at Rome after about seven years, he issued a list containing nine hundred propositions which he offered to maintain against any antagonist (1486). Some of these being deemed heretical, he published an *Apologia*, but his orthodoxy remained doubtful till Alexander III. issued a brief in his favour in 1493. The latter part of his life was spent chiefly at Florence, where the influence of the humanists Politian and Ficinus was counteracted by that of Savonarola. His views became more and more austere, and it is probable that if his life had been prolonged he would have joined the preaching friars.

Picotée, that group of florist's varieties of the carnation (q.v.) (*Dianthus Caryophyllus*) in which the edges of the petals are "laced" or edged with a distinct colour.

Picric Acid. [CARBAZOTIC ACID.]

Picton, SIR THOMAS (1758-1815), British general, was born in Pembrokeshire. He was ordered to the West Indies in 1784, and became Governor of Trinidad in 1797. He commanded a brigade in the Walcheren expedition (1809), and was appointed Governor of Flushing. During the Peninsular War he commanded the "Fighting Division," distinguishing himself especially at Badajoz and Vittoria. He was severely wounded at Quatre Bras, but concealed the fact in order that he might take part in the battle of Waterloo, in which he was killed by a musket-shot.

Picts, an ancient race that formerly inhabited great part of Scotland, and whose origin and affinities form a vexed ethnological question. It has been much disputed whether they were of Teutonic or Celtic origin, and even as to their name it is doubted whether it is from the Latin *Picti*, given them by the Romans and alluding to their habit of painting their bodies, or whether they called themselves thus. One authority (Pinkerton) makes them Scythians from the neighbourhood of the Danube; but it seems more probable that they were of Celtic stock, especially when we consider that at a later period they readily amalgamated with the Scots. Their language evidently differed from the other dialects of Scotland, since we find that St. Columba needed an interpreter when speaking to them. The Picti are mentioned by the Romans in 296 A.D., and again in 360 A.D., as inhabiting that part of Scotland which lies N. of the Forth and Clyde, with the exception of what is now Argyll and was then inhabited by Dalriada Scots from Ireland. The Grampians separated the Northern from the Southern Picts, the latter of whom became much mixed up in Northumbrian affairs. The Northumbrian rule was established over the southern Picts in the early part of the 7th

century, but in 685 the Picts conquered Egfred and gained the upper hand. Their king, Necktan, founded the monastery of Abernethy, and was beaten by Angus Macfergus, who succeeded him and conquered the Northern Picts and the Scots of Argyll. Later, however, these Dalriada Scots obtained the ascendancy, and under their supremacy an amalgamation of the peoples was brought about.

Piddock. [PHOLADIDÆ.]

Piedmont, an Italian department S. of Switzerland, W. of Lombardy, and E. of France, is at the foot of the Alps, having the Lepontine and Pennine Alps to the N. and N.W., the Graian and Cottian on the W., the Maritime Alps and the Apennines to the S. There is a gradual descent from the mountains to the valley of the Po, and the district is wonderfully fertile. The Po receives many tributaries, including the Mairia, Tanaro, Scrivia, Ticino and others, and these are much used for the purpose of irrigation. Wheat, maize, rice, beans, hemp, hay are largely cultivated, and the province produces wine, cattle, and millions of silkworms, silk being exported to the value of £100,000 a year. Iron, lead, copper, and marble are worked; and there are manufactures of silk, woollens, cotton, and flax. Grain, cotton, silks, hides, flax, wine, and wool are exported. Turin is the capital, and was from 1860 to 1865 the capital of the new kingdom of Italy. The Waldensian Church still exists in the mountainous districts.

Pierce, FRANKLIN (1804-69), 14th President of the United States, was born at Hillsborough in New Hampshire. He was admitted to the bar in 1827, and six years later was elected to Congress, where he attached himself to the Democratic party. He was a member of the Senate from 1837 to 1842, and afterwards served in the Mexican War (1846-47). His election to the presidency took place in 1852. He was a firm and conscientious believer in slavery, and excited a very strong feeling among the Free State party by approving the repeal of the Missouri Compromise and the Nebraska-Kansas Act for the organisation of Nebraska and Kansas as slave territories.

Pietermaritzburg, so-called after the Boer leaders Pieter and Maritz, is the capital of Natal, and is built on a plateau near the river Umgeni, 54 miles N.W. of Durban, with which it is connected by a railway. It has also railway communication with the Orange Free State and the Transvaal. It is a pleasant, prosperous town, with broad streets shaded by trees. The chief buildings are the Government House, two cathedrals, the town hall, and the museum.

Pietism, the principles of the Pietists of the 17th century in Germany, who advocated a more practical type of piety and the participation of the laity in the spiritual work of the Church. Their leader was Spener.

Piezometer is an instrument which measures the compressibility of a fluid. If a pressure of p pounds per square inch be applied throughout a liquid whose volume was originally v cubic inches,

it will cause this volume to diminish. If the final volume is $v - r$ cubic inches, the compressibility is $\frac{r}{p v}$. A piezometer is provided with arrangements for measuring r and p . The best-known form of the instrument is that devised by Oersted, and it was by means of this that the compressibility of water was first determined with any accuracy. A large bulb provided with a small capillary tube contains the liquid whose compressibility it is required to measure, while a drop of mercury at the top of the liquid in the tube acts as an index. The capillary is graduated, and is open at the top. The whole of this apparatus can be placed inside a large strong glass cylinder, into whose neck a piston tightly fits. This cylinder is filled with water, and a great pressure can be produced throughout its volume by a downward thrust of the piston. Under this increased pressure the experimental liquid is seen to descend in its capillary tube, and the amount of descent is indicated by the bubble of mercury. Previous experiments having determined the value of each graduation on the tube in terms of the total contents of the bulb, the descent of the index measures the decrease of volume (r) which the liquid has suffered. The pressure p may be measured by placing a graduated cylinder of air inside the large vessel. The water will from the first rise some distance in this vessel, and as the pressure is increased the volume of contained air will become visibly less. By suitably graduating this cylinder the increased pressure can be read off. Knowing v , the original volume of our experimental liquid, and having measured p and r , we can determine the required compressibility. An air bubble in the capillary tube is often used as an index instead of the mercury, in which case the liquid must fill the bulb and tube almost to the top. The bubble, whether of air or mercury, prevents the water in the outer vessel from coming into contact with the liquid in the tube. Allowance has to be made for the diminution in volume of the bulb itself under the increased pressure.

Pig, HOG, any individual of the family Suidæ, belonging to the even-toed division of Hoofed Mammals, and confined to the Old World. The snout, with which these animals turn up the ground in search of roots, worms, and insects, is elongated, and the nostrils are placed in the flat surface at its end. There are four digits on each limb, the third and fourth functional, while the outer ones (the second and fifth) do not reach the ground. In the type-genus *Sus* the dentition is $i \frac{3}{3} c \frac{1}{1} p \frac{4}{4} m \frac{3}{3} = 44$. In the males the canines are developed into tusks. The body is covered with hair, generally in the form of bristles. [BOAR.] The pig (*Sus scrofa*) has been greatly changed by domestication, which took place at an early period, and it has run into many breeds, those being most valued which fatten readily, covering a small frame with a good yield of meat, and are prolific. The flesh, fresh or cured, is almost universally eaten for food, except by Jews and Mohammedans, to whom it is forbidden by their sacred writings (Lev. xi. 7; Koran, ch. ii.). [BRAWN.] The fat is rendered

down into lard; the skin is used for saddlery; the bristles are worked up into brushes and employed by shoemakers to point their threads. From its omnivorous habits the pig is profitable to keep, for it will devour almost anything—though offal and garbage should not be given, as these would taint the flesh, or at the least give an unpleasant flavour; and if turned out into fallows, stubble, or woods the animal shows a marvellous faculty for picking up a living. The pig is often reproached with want of intelligence, and with being dirty. Wild pigs are anything but stupid; and “learned” pigs show that the domesticated form is capable of being trained. The charge of being dirty is equally baseless. Pigs like to wallow in the mud, and to cover themselves with it; so do buffaloes, and the reason in both cases is the same—protection is sought against insect pests. The Indian Pigmy Hog (*S. salvianus* = *Porcula salviana*), from the forest at the base of the Himalayas, Sikkim, and Bhutan, stands a little less than a foot high at the shoulder, and an old male, twenty-six inches from snout to rump, weighed but 17 lbs. The Bush Hogs or River Hogs constitute the genus or sub-genus *Potamochoerus*. There are two species, the South African River Hog (*P. africanus*), the Bosch-vark of the Dutch colonists, in which the coloration is grey; the West African Red River Hog (*P. porcus*), of a reddish hue, and having the ears greatly elongated, and tipped with a tuft of hairs. There is usually one premolar less on each side than in the Boar. Their young, as well as those of the Pigmy Hog, show the stripes which are so marked in the young of the Wild Pig. In those of the Babirusa (q.v.) and of the Wart Hog, this character is absent. The Wart Hogs are African in their habitat, and constitute the genus *Phacochoerus*. The snout is broad and flat, and has none of the flexibility that marks the snout of the Common Pig. The skin of the face is wrinkled, and on each side are large wart-like projections. The upper canines are larger than those in the lower jaw, and curve upward in the same direction. These tusks are present in both sexes. There are two species, Ælian's Wart Hog (*P. ælianus*), ranging nearly over the continent, and Pallas's Wart Hog (*P. æthiopicus*), confined to the south-east.

Pigeon, DOVE, a name often applied to any Columbiform bird, sometimes restricted to individuals and species of the type-genus (*Columba*) of the group. These have the bill moderately long, somewhat arched at the tip, and the upper mandible is covered at the base with skin, in which are the nostrils; there are three toes in front, divided to the base, and one behind; the wings are pointed, and the tail generally square at the end. Pigeons, in the wider sense of the word, are widely distributed, but are most abundant in the Australian region, where about half of the known species are found. They are very prolific and rear several broods (never more than two in each) during the year. In the wild state they are said to pair for life, and the male bird takes his share in sitting, and in feeding the young. The origin of all our domestic breeds is the Rock Pigeon (*C. livia*),



PIGEONS.

1 Homing Pigeon. 2 Tumbler. 3 Carrier. 4 Barb. 5 Pouter. 6 Fantail. 7 Satinette. 8 Turbiteen.
9 Jacobin. 10 Trumpeter.

found nearly everywhere throughout the Old World. The total length is about thirteen inches; the general plumage light bluish-grey, with two black bands on the wings; throat and sides of neck glossed with metallic reflections of purple-red and green. These birds live chiefly on grain and seeds, and do considerable damage to gardeners and farmers. The only other British species are the Ring Dove, Wood Pigeon, or Cushat (*C. palumbus*), in which some of the neck-feathers on each side are tipped with white; and the Stock Dove, or Smaller Wood Pigeon (*C. ænas*), which has no white on the neck. The name Pigeon, with some distinguishing epithet, is used for other groups of Columbiform birds, as the Ground Pigeons, Fruit Pigeons, Tree Pigeons, etc. Fancy Pigeons afford one of the best examples of what may be done with domesticated animals by judicious selection on the part of the breeder, so as to perpetuate and intensify some variation. Among the chief breeds valued by fanciers are the *Homing Pigeon*, *Carrier Pigeon* (q.v.) and the *Barb*, so-called because it came originally from Barbary, with its beak and eyes wattled. Another wattled pigeon is the *Dragoon*, from which the *Carrier* was developed. In the *Pouter* the crop is abnormally large and round, and so raised to the front that the beak is hidden. The *Jacobin* has the head and neck so covered with feathers as to present a distant resemblance to a monk with his cowl. (*Jacobin* is the old French name for a Dominican friar). Other varieties are the *Tumblers*, which are so named from their habit of turning somersaults backwards during flight; *Funtails*, which spread out the tail-feathers like a fan, something like those of a turkey cock in his display, but without trailing the wings; the *Satinettes* and *Turbiteens*, which belong to the group of Oriental Frilled Pigeons; down the breast extends a frill of feathers, and the head may be plain or crested.

Pigeon English, i.e. "Business English," a sort of jargon or *lingua franca* serving as the medium of intercourse between the natives and the English and other white traders on the Chinese seaboard; the words are mainly English in a more or less mutilated form, the structure Chinese; hence it is at first quite unintelligible even to those well acquainted with both languages. In recent years this jargon has penetrated inland, and is now often used as a means of communication between the natives of the provinces of Kwangtung and Fokien, whose respective dialects differ so greatly as to be mutually unintelligible. A similar "Pigeon Russian" has become current amongst the compradors or Chinese commercial agents of Kalgan on the Mongolo-Chinese frontier. (Prjevalsky, *Mongolia*, I. p. 41.)

Pig-Iron. [IRON.]

Pigments are insoluble coloured substances which, when ground up with a suitable medium, usually oil or water, can be employed for painting. In their nature and composition they vary greatly; many are natural mineral substances, others are artificially-prepared inorganic compounds, whilst others again are organic colouring material prepared usually by synthetic reactions. The natural

substances, and frequently also the artificial products, require to be very finely ground before use. For artists' colours this grinding has to be much more carefully done than in the case of the pigments for house-painters, etc. The grinding is usually done by means of revolving stones, the pigments being ground either dry or mixed with oil or water. Artists' colours, after careful grinding, are usually stocked and sold in collapsible tubes, or, in case of water-colours, as hard cakes or softer moist colours.

White pigments may consist of a number of different compounds. Amongst these some of the most common are *lime*, used as a coarse white-wash for walls, ceilings, etc.; *white lead* (q.v.), one of the most common of all pigments, although it blackens if exposed to sulphur fumes and has certain dangers in its preparation; *zinc oxide* or *Chinese white* (q.v.); and *permanent white* (q.v.), which consists of sulphate of barium either natural or, better, prepared artificially.

Black pigments are usually more or less impure forms of carbon obtained by heating various vegetable or animal substances, and indicating by their names the source whence obtained, as e.g. ivory-black, bone-black, lamp-black, etc. Oxides of manganese are also used, and aniline black; while tar is also frequently employed for painting wood, etc., possessing a powerful anti-corrosive action.

Yellow pigments consist chiefly of oxides of iron and some salts of chromium and lead. The first class constitute the pigments known as ochres (q.v.), varying in shade from yellow to brown, according to the quantity and nature of the oxides of iron contained. *Chromates of strontium* and *lead* form valuable yellow pigments, while a compound of lead and antimony oxides forms the well-known *Naples yellow*. *Gamboge* is a natural organic pigment, as is also *Indian yellow*.

Blue pigments comprise a number of important colours, as indigo, Prussian blue, and ultramarine (all of which see). Besides these, certain salts of cobalt find application as pigments under names of *smalt*, *cobalt blue*, *azure blue*, etc.

Green compounds include chiefly compounds of copper and arsenic. The latter are highly poisonous; and, although bright and brilliant, their use on wall-papers, etc., is highly to be condemned. Of late years their use has largely decreased. The commonest are Scheele's green and Schweinfurth's green. *Brunswick* and *Bremen green* are copper compounds, as is also *verdigris*. Cobalt green possesses good colour, and consists of compounds of cobalt and zinc. *Sap-green* is a natural organic green obtained from blackthorn berries, but possesses little body. Greens may also be obtained by proper admixture of yellow and blue pigments.

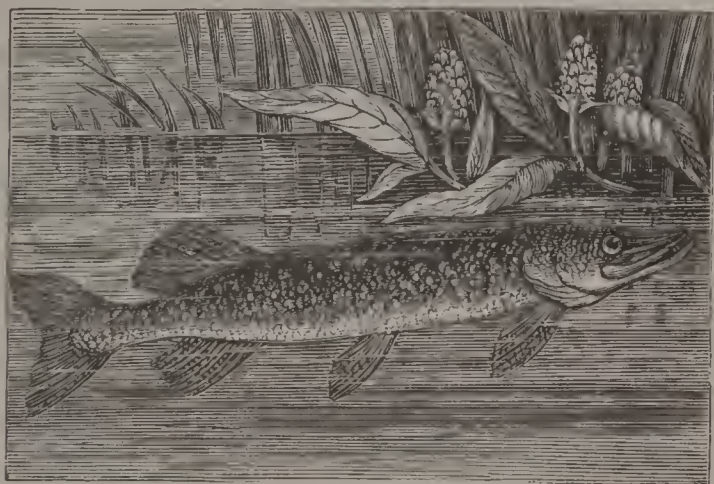
Red pigments comprise a number of important compounds. Amongst these are the *lakes* (q.v.) from madder, cochineal (forming *erimson lake*), and lac lake. Carmine is obtained from the cochineal insect. *Cinnabars* and *vermilion* are brilliant pigments, consisting of the sulphide of mercury, but are frequently adulterated with *red lead* or *minium*, itself a common red pigment. Venetian red, rouge, Turkey red, and some others, are all oxides of iron,

the first being mixed with some earthy matter, the two latter being pure oxides.

Brown pigments consist chiefly of ochres. Some browns are obtained from bituminous soils, while the commonly-used sepia consists of a secretion of the cuttle-fish. A large number of substances not named also enter into various pigments, while many also are especially prepared for certain purposes, and hence contain special ingredients, as *e.g.* to prevent corrosion, decay, etc. For more detailed descriptions, also *see* the articles treating on the various pigments, VERMILION, RED LEAD, etc.

Pigmies, Pygmies, a loose general term for races of man that are far below the average height. Used chiefly of certain tribes in Central Africa. [NEGRITOES.]

Pike, any fish of the Physostomous family Esocidæ, with a single genus (*Esox*) containing five or six species, all valued for the table. The Common Pike (*E. lucius*) is British, but is found



PIKE (*Esox lucius*).

also in Europe, Asia, and America, and to the latter continent the other species are restricted. The body is covered with scales; barbels and adipose fin absent, and the dorsal fin is set just above the anal. The Pike or Jack is olive-grey above, with pale mottlings, and silvery-white beneath. It is said to attain a length of from five feet to six feet, but specimens of from two feet to four feet are much more common. It is extremely voracious; its ordinary food consists of frogs and young fish; but ducklings, goslings, young moorhen, and water-rats are often devoured. It is long-lived; but the story of the pike 250 years old is an invention or more probably founded on a mistake.

Pilate, PONTIUS, was Roman procurator of Judæa, Samaria, and Idumæa from 26 to 36 A.D., and in that capacity sat in judgment on Christ. He showed a complete disregard for the religious feelings of the Jews, whose complaints eventually led to his recall. He is said by Eusebius to have committed suicide whilst living in exile at Vienne in Gaul. According to ancient legend, his body caused the greatest commotion when thrown into the Tiber; and, the same result following elsewhere, it was at last sunk in a deep and lonely pool on Mount Pilatus near Lucerne.

Pilatus, MOUNT, an Alpine peak in Switzerland, is on the borders of the cantons of Lucerne and

Unterwalden, near the town and lake of Lucerne. The highest point reaches 7,000 feet. The fine view obtainable from its summit has led to the construction of a pathway and railway. The name is probably derived from Latin *Pileatus*, "hatted," on account of the clouds which often clothe its summit.

Pilchard (*Clupea pilchardus*), a very valuable food-fish of the same genus as the Herring (*q.v.*), which it greatly resembles, though somewhat smaller. It may, however, be distinguished by the radiating ridges on the gill-cover. It is abundant in the English Channel, on the coast of Portugal, and in the Mediterranean. The average length of those taken off the coasts of Devon and Cornwall is about 10 inches; the French Pilchards or sardines are much smaller, owing to the fact that the young fish are taken and tinned for the market. Pilchards are also put up in oil in the same way in Cornwall, and there is a factory at Deal where sprats are tinned. The pilchard fishery is of great importance commercially. It commences in August, and is carried on till the April following. The fish which are not required for home markets are salted in vats, pressed, and packed in hogsheads for exportation. A hogshead weighs nearly 500 lbs., and contains from 2,500 to 3,000 fish; and some 15,000 hogsheads are annually sent to the Mediterranean ports. The pilchards feed upon small crustaceans and other minute marine organisms. The spawn is quite transparent, and is shed on the surface of the water, where it floats till the eggs are developed.

Pilcomayo, a South American river, rises in Bolivia, and has a course of over 1,500 miles, first S.E. past Chuquisaca, then, after receiving the Pilaya, S.W. between Argentina and Paraguay, falling into the Paraguay a few miles S. of Asunción. About 100 miles from the mouth it divides into two branches, one of these again dividing into two. The rapid current in parts, and shallowness in the dry season, render navigation well-nigh impossible.

Piles (HÆMORRHOIDS) are tumours formed by the dilatation of the veins or by thickening of the folds of skin or mucous membrane in the neighbourhood of the anus. Piles are of two varieties, *external* and *internal*, the latter being situated within, and the former outside, the sphincter muscle. In the case of internal piles one of the most characteristic symptoms is bleeding. Piles are caused by obstruction to the return of blood through the veins of the lower bowel, one of the most important predisposing causes being habitual constipation. Treatment consists in the regulation of the action of the bowels and in the local application of some astringent preparation such as the compound gall ointment. In some instances operative treatment is necessary to remedy the condition.

Pilgrim Fathers is the name applied to that body of English, Scottish and Dutch emigrants who embarked on the *Mayflower* at Southampton in 1620, and, landing at Plymouth in Massachusetts, were the pioneers in colonising New England.

Pilidium, a larval stage in the worms belonging to the class of Nemerteans. It has a rounded, somewhat bell-shaped body, inside which the new

worm develops around the alimentary canal of the embryo.

Pill-millepedes, a group of small millepedes (or Diplopoda) forming the family *Glomeridae*, and characterised by their habit of rolling up into a ball like the common wood-louse (*Oniscus*).

Pillory, a mode of punishment now obsolete. It consisted of a raised scaffold upon which was a cross formed of planks. At the junction of the arms and upright of the cross was a hole, corresponding with a hole in each of the arms, and in these holes the neck and wrists of the culprit were secured, and he was subjected to the abuse and maltreatment of the populace. The punishment was abolished, except in cases of perjury, in 1816, and entirely abolished in 1837. Titus Oates was put into the pillory for perjury, and its use in the colony of New England is mentioned by Hawthorne in his *Scarlet Letter*.

Pills are small masses containing various active substances mixed with treacle, liquorice, soap, confection of roses, and the like. Drugs are usually administered in pill form when they are designed to act slowly or to remain inoperative until the pill reaches the intestines.

Pilot-fish (*Naucrastes ductor*), a small fish, allied to the Horse Mackerel, common in tropical and temperate seas. In form it is not unlike a mackerel; its colour is generally bluish-grey, with five dark-blue vertical bands. It constantly follows ships and large fish, especially sharks. The precise nature of the connection between the Pilot-fish and the Shark is unknown; but Günther endorses Meyen's opinion that the former feeds on the excrements of the latter, and says that it also picks off the parasitic crustaceans with which the shark, like all large fish, is infested.

Piloty, KARL VON (1826-86), an eminent German painter, born at Munich. He became director of the Munich Academy in 1874. Some of his best historical pictures are in the Maximilianeum and New Pinakothek of his native town.

Pilsen, a town of Bohemia, is on a plain just above the junction of the rivers Mies and Bradawka, 53 miles S.W. of Prague. It is a well-built city, consisting of town proper, and suburbs. There is a fine 13th-century Gothic church. The chief manufactures are machinery, metal wares, porcelain, glass, liqueurs, spirits, and the widely-known Pilsener beer. Coal, iron, and alum are found in the neighbourhood.

Pimas, North American aborigines, partly in Arizona, United States, but chiefly in the conterminous Mexican states of Sonora and Sinaloa; they speak numerous dialects of a stock language, which, however, has been affiliated by Buschmann, on insufficient evidence, to the Aztec family. Chief divisions in Arizona: Pima Alta, Gila River, for 200 years allies of the Coco Maricopas; Papago, widespread in South Arizona and Mexico; Sobai-puri, Santa Cruz, and San Pedro affluents of the Gila, apparently extinct. Chief divisions in Mexico: Papago, Pima Baja, Opata, Cora, Cahita,

Tarahumara, and Tepeguana. Those in the United States, collectively numbering nearly 10,000 in 1890, are now confined to the Pima Agency, 65,000 acres on both sides of the Gila River, Arizona. Those of Mexico, sometimes called "Pueblo Indians" because occupying fixed *pueblo* or village settlements, are estimated from 70,000 to 80,000. But in the Pima family have been included many tribes that really belong to the Yuma and other connections.

Pimento. [ALLSPICE.]

Pimpernel (from the Keltic *pimper*, "five"), the popular name for several little creeping plants with five-pointed corollas, especially *Anagallis arvensis*, the scarlet pimpernel, or poor man's weather-glass, *A. carulea*, the blue, *A. tenella*, the bog, and *Lysimachia nemorum*, the yellow or wood pimpernel, all members of the primrose family. The genus *Anagallis* has capsular fruits which, with those of a few other plants, split transversely when ripe. *A. arvensis* is a weed in cultivated ground. Its petals close in wet, cloudy, or threatening weather. *A. tenella*, with pale pink funnel-shaped flowers, grows in peaty bogs.

Pimples. [PAPULES.]

Pinchbeck, an alloy of copper and zinc, containing more copper than ordinary brass. The proportion is usually about three parts of copper to one part of zinc. It possesses a reddish yellow colour, is malleable, and can be worked with comparative ease.

Pindar (522?-443 B.C.), the greatest lyric poet of Greece, was born at Cynoscephalæ near Thebes. He was descended from a musical family, and studied flute-playing under Lasus of Hermione at Athens. In his youth he derived much benefit from the advice of his townswoman, the poetess Corinna, who several times defeated him in public contests. He resided at the courts of Hiero of Syracuse and Thero of Acragas, yet so far was he from sacrificing his independence that he introduced friendly advice into the verses composed for these princes. His affectionate regard for the city of Athens was rewarded with the *proxenia*, an office the duties of which consisted in entertaining and assisting the Athenians who visited Thebes. Pindar's poems, which cover a period of fifty years (502-452 B.C.), include hymns to the gods and encomia in praise of men, dithyrambs (q.v.), pæans (q.v.), prosodia (processional songs), parthenia (choral songs for maidens), skolia (festal songs), and threnoi (dirges). Besides beautiful fragments representing each of these types, we possess in their entirety four books of *epinikia*, odes of victory celebrating the successes achieved at the great national games—Olympian, Pythian, Nemean, and Isthmian. In these compositions the praises of the hero are blended with mythical narratives and moral reflections, the whole being wrought together into a strain of the loftiest and most glowing enthusiasm. The language is epic, with a Doric element. It is now known that the extraordinary variety in the metre was not due to the poet's caprice, but

was strictly conditioned by the requirements of the musical accompaniment. [ODE.]

Pine, a name now restricted by botanists to the genus *Pinus*, which includes about seventy species of cone-bearing trees, natives of the northern hemisphere, and mostly extra-tropical. Growing socially, they form extensive forests in the north of



PINE (*Pinus pinea*).

Europe and America, often exclusively of a single species. One, the Northern Pine or Scots Fir (*P. sylvestris*), is native in the north of Britain. The distinctive characters of the genus are that its prismatic needle-like evergreen leaves are borne on dwarf shoots, two, three, or five together, in the axil of a membranous scale-leaf, and that the cone persists, the apex of its scales becoming a thick woody rhomboid *apophysis* with a central point. The leaves vary from an inch to a foot in length, and sometimes remain several years on the tree. The flowers are monœcious, the male consisting of numerous imbricated sporophylls (stamens) each bearing two pollen-sacs, and the female of a cone, each scale of which bears two ovules. The pollen-grains have bladder-like expansions of the extine, and the seeds, which are sometimes large and edible nuts, generally have a thin wing. The timber, tar, and turpentine of the various species are highly important in the arts and in commerce. The Northern Pine occurs in Siberia and over most of Europe. It yields Red, Norway, Riga, or Baltic Pine. In Scotland it is the badge of the Clan M'Gregor. *P. Pinaster*, the Cluster or Maritime Pine of southern Europe, binds together

with its roots the shifting sands of the Landes, and yields Bordeaux turpentine; *P. Pinea*, the Stone Pine of southern Europe, is our chief species with edible nuts; *P. rigida* and *P. australis*, the Pitch Pine (q.v.) of northern and southern United States respectively, yield one of our chief timbers.

Pineal Body, or GLAND. [BRAIN.]

Pine-apple (*Ananas sativa*), a South American biennial plant belonging to the Bromeliaceæ, with rigid, spinous, aloe-like leaves, and a remarkable infrutescence, all the scaly perianth-leaves and the fruits of a flowering branch becoming imbedded in the exterior of the fleshy mass of the branch. This branch terminates in a crown of leaves, and externally resembles in its rhomboid withered flowers the cone or "apple" of the pine (q.v.), whence its name. Though fibrous, this branch becomes one of the sweetest and most delicately and distinctively flavoured of dessert "fruits." First known to Europeans in Peru about the middle of the 16th century, the first to reach England came as a present to Oliver Cromwell. The pine-apple may have been grown in this country as early as the reign of Charles II.; and, though expensive to cultivate, owing to the heat necessary, English-grown specimens surpass those of the tropics both in size and flavour. We now import great quantities from the Azores and Bahamas, both fresh and preserved in syrup.

Pinero, ARTHUR WING (b. 1855), actor and dramatist, born in London, has written *The Squire* (1881), *Sweet Lavender* (1888), *The Second Mrs. Tanqueray* (1893), etc.

Pink, the garden name for several species of *Dianthus*, a large genus of Caryophyllaceæ. They are mostly natives of the temperate regions of the Old World, and are distinguished by having two or more bracts at the base of a cylindric calyx-tube, and two styles. The ovary, though with "free central" placentation (q.v.), exhibits rudiments of septa between its constituent carpels. Their foliage is generally linear and often glaucous; their flowers white or some shade of pink or red, often dotted or lined with white, or with a ring of another shade, and with fringed margins to the petals.

Pinkerton, JOHN (1758-1826), a voluminous author and compiler, born at Edinburgh. In 1780 he settled in London, whence he removed to Paris about 1802. His works include *Letters on Literature* (1785), a *History of Scotland* (1797), and a *General Collection of Voyages* (1808-13).

Pink Eye, a term applied to a disease which affects horses.

Pinna, or the "PEARL MUSSEL," is one of the genera of mollusca belonging to the class Lamelli-branchiata, from which pearls are derived. The pearls are formed by a secretion from the mantle over sand grains or other bodies which get between the mantle and shell and thus irritate the animal. The shells are sometimes two feet in length and are attached by a beard or byssus, the fibres of which have been woven. The shells of the fossil

genus *Trichites* found in the English oolites are sometimes over a yard in length.

Pinnate (from the Latin *pinna*, "a feather"), a term applied to compound leaves when the leaflets (*pinnae*) are arranged along the sides of a mid-rib or *rachis*. If there is an odd leaflet terminating the rachis, as in the rose or the elder, the leaf is *imparipinnate* or *unequally pinnate*; if not, as in *Acacia*, it is *paripinnate*, equally or abruptly pinnate. If the pairs of leaflets (*juga*) are alternately large and small, as in the potato, the leaf is *interruptedly pinnate*, as is also the leaf of *Agri-*monia**, which, having a larger terminal leaflet, is also termed *lyrately pinnate*. When some or all of the divisions of a pinnate leaf, still termed *pinnae*, are themselves pinnate, so that the *primary rachis* bears *secondary rachides*, the leaf is *bipinnate*; or if again divided, as in many ferns, *tri-pinnate*. The ultimate leaflets are called *pinnules*. A simple leaf lobed in a similar manner may be *pinnatifid*, *pinnatifartite*, or *pinnatisect*, according to the depth of the lobings.

Pinnigrada. [CARNIVORA.]

Pins are one of the most useful and necessary adjuncts of dress, and as such have been in use from time immemorial and in very early stages of civilisation—thorns, fish-bones, and metal having all been pressed into the service. The common pin, as now known, generally consists of brass, and undergoes numerous processes before being fit for its intended purpose. Steel is also employed for larger fastenings and especially for securing the hair and woman's head-gear, in these cases becoming at times a formidable stiletto-like weapon.

Pintail, any duck of the genus *Dafila*, from the northern parts of both hemispheres. The tail is long and pointed.

Pinto, FERNAO MENDEZ (*circa* 1510–83), a Portuguese traveller. His *Peregrinação* is a record of marvellous adventures, in Arabia, Persia, the Indies, China, and Japan, extending over a period of 21 years (1537–58). In spite of much exaggeration, the general veracity of the work is now acknowledged.

Pinturicchio (BERNARDINO DI BETTI), (1454–1513), an Italian painter, born at Perugia. One of his most important works is a series of frescoes in the library at Siena, depicting incidents in the life of Pope Pius II.

Piozzi, HESTER LYNCH (1741–1821), was the daughter of John Salusbury, of Bodvel, Carnarvonshire, where she was born. She received a very liberal education and was married in 1763 to Henry Thrale, a rich brewer of Southwark. Their house at Streatham speedily became a resort of the literary notabilities of the time, although Thrale was quite incapable of appreciating his wife's talents. Dr. Johnson became acquainted with Mrs. Thrale through Arthur Murphy in 1764, and for 20 years she remained his closest and most sympathetic friend. He travelled in Wales with the Thrales in 1774, and in France in 1775. Thrale died in 1781; three years later, much to Johnson's indignation,

she married an Italian music master named Piozzi. In 1809 she again became a widow. From 1814 onwards she lived chiefly at Bath, Clifton, and Penzance. Of Mrs. Piozzi's numerous works the *Anecdotes of Dr. Johnson* and *Letters to and from Dr. Johnson* alone survive.

Pipa. [SURINAM TOAD.]

Pipe. 1. A liquid measure, used chiefly in the wine trade, and varying with the wine for which it is used—*e.g.* a pipe of port generally contains 138 gallons, that of sherry 130 gallons.

2. A tube used for the passage of gases, liquids, etc., and made of all kinds of material. Pipes of lead or clay and other plastic material are made by passing the clay or molten lead through a cylinder the interior of which is occupied by a solid mandril. The old method of making iron piping was to bend a plate of the metal and solder the edges together; but the process now generally followed is to cast a cylinder of iron around a steel mandril with a projecting point with conical end. This mandril end is passed through a hole in a steel post, and is grasped by machinery which draws the cylinder through the hole, thus spreading the metal equally on the outside while the mandril preserves the internal diameter. Tobacco-pipes are generally made in two pieces: a rolled cylinder through which wire is thrust, and a lump of clay which is welded to the stem and shaped outwardly by a mould, the interior of the bowl being shaped by the introduction of an oiled stopper. Care having been taken that the hole through the stem penetrates to the bowl, the stem is bent to the required curve, the pipe is trimmed and finished off, and then baked, eight or nine hours sufficing to turn out 50 gross of pipes. Tobacco-pipes vary in material from the homely corn-cob of the southern States to the highly-finished meer-schaum for which Vienna is chiefly renowned, or the bejewelled, hookah and narghile of the East. A kind of cherry-wood grown near Vienna and the mock-orange of Hungary are in great request for pipe-stems; while the "briar-root" pipe (made from the root of a heath, *bruyera*) is universally known, as are the scented pipes which are known as myall-wood.

Pipe-clay, a fairly pure white clay (q.v.), free from iron and alkalies, so that it does not fuse into a glass. It, however, contracts so in baking as to be useless for pottery. It occurs in the Middle Eocene or Bournemouth Beds of Alum Bay, Studland, Corfe, and Bovey Tracey (Devon), and often contains numerous well-preserved fossil leaves. It seems to have been formed from the decomposition of some felspathic rock, and to have been deposited in old lake-basins. Used in making tobacco-pipes and in cleaning military accoutrements.

Pipe-fish, a popular name for any fish of that group of the family Syngnathidæ in which the tail generally has a caudal fin, but is not prehensile as it is in the Sea-horses. The jaws are tubular, and the body is greatly elongated. The males usually carry the eggs till they are hatched in a pouch or glued to the abdomen. The Great Pipe-fish (*Syngnathus*

acus) is common on both sides of the Atlantic, and far from rare in rock-pools on our coasts. Three species of the allied genus *Nerophis* are also British. The name is sometimes given from its shape to the Tobacco-pipe fish (*Fistularia tabaccaria*), which belongs to a different order.

Piping-crow, any bird of the Australian genus *Gymnorhina*, of the Crow family, with several species, one of which is often domesticated and mimics the human voice.

Pipit, any bird of the genus *Anthus* of the Wagtail family. Like the larks, which they resemble in appearance, these birds sing on the wing; but they have two moults in the year, while the larks have but one. Three species are British: the Meadow Pipit, Titlark or Moss Cheeper (*A. pratensis*), by far the most common; the Tree Pipit (*A. trivialis*), which comes to us in summer; and the Rock Pipit, or Rock Lark (*A. obscurus*). The first and last named species are resident.

Piquet, a game of cards of French origin, is played by two persons with a pack of 32 cards, all those between ace and seven being rejected. The player cutting lowest deals, and the cards are dealt, two by two, until 12 are out to each hand, the remaining eight lying on the table as stock. The elder hand then discards five cards or fewer, drawing fresh ones from the stock, and then the dealer discards three or fewer, or none, according to his discretion. The game consists of 100 up, and the system of scoring and marking is somewhat complicated.

Piracy. The crime of piracy or robbery and depredation on the high seas is an offence against the universal law of society—a pirate being, according to Sir Edward Coke, *hostis humani generis*. As, therefore, he has renounced all the benefits of society and government, and has reduced himself afresh to the savage “state of nature” by declaring war against all mankind, all mankind must declare war against him; so that every community has a right by the rule of self-defence to inflict that punishment upon him which every individual would, in a state of nature, have been otherwise entitled to do for any invasion of his person or personal property. By an early statute of the present reign the crime of piracy is made punishable, at the discretion of the court, by transportation for life or for any term not less than 15 years or to be imprisoned for any term not exceeding three years.

Piræus, the harbour of Athens, is situated five miles from the city on a peninsula. Formerly Phalerum was the harbour; but Themistocles saw the value of the peninsular position, and began to construct the harbour. The Long Walls, connecting the new harbour with Athens, were built between 457 and 431. They were destroyed by the Spartans at the end of the Peloponnesian War, were restored by Conon, but fell later into ruins. There were originally three harbours, two on the E.: Zea (Stratitiki) and Munychia (Phanari), and on the W. Piræus, which was divided into Cantharus (for war ships) and Emporium (for merchant vessels). The harbour is deep, and admits large vessels. A carriage road and two railways lead to Athens.

Pisa, a town of North Italy, capital of the province of the same name, is situated on the Arno and on the Florence and Leghorn Railway, 6 miles from the sea, and 44 miles W. of Florence. The river is crossed by three stone bridges, and one railway bridge. The town has a citadel, and is surrounded by walls and ditches enclosing a circumference of 6 miles. It has handsome streets, good quays, and fine houses. The 12th-century Duomo is of white marble, and has a dome



Frith & Co., Reigate, phot.
THE LEANING TOWER, PISA.

supported on seventy-four pillars, and contains good paintings, sculptures, and mosaics. The Baptistery has also a dome 190 feet high. The famous Leaning Tower is 179 feet high, and 13 feet out of the perpendicular. A fine view is obtainable from the top. The cemetery called Campo Santo is of interest, and there is a famous university. The chief productions are silk, woollens, cottons, worsted, soap, white-lead, vitriol, corn, and oil. The province, containing 1,180 square miles, is fertile, hilly in the centre and south-east, but occupied in the north-west by lakes and swamps. The city of Pisa was anciently one of the twelve cities of the Etrurian federation.

Pisano, NICCOLA (*circa* 1206–78), a renowned sculptor and architect of Pisa. The pulpit in the Baptistery and the shrine of St. Dominic at Bologna are among his finest works.

Pisciculture, or REARING OF FISH, is a term now generally applied to the system of artificial hatching or rearing of fish, molluscs, or crustacea. The treatment of eggs has been so worked out that eggs can be sent across the ocean without any appreciable loss; and young fry can be carried safely for long distances. The objects in view in pisciculture are (1) the saving of a greater percentage than would survive in a natural state, and (2) the protection of the fry from many dangers. The process of fertilising and hatching, applied to

the salmon is somewhat thus:—The gravid salmon is held over a pan, into which she discharges the ova, and upon these the milt is squeezed from the male, and the pan is tilted to ensure fertilisation. Water is then added, and the pan allowed to rest for a time, after which the milt is poured off, and the eggs left to hatch. After hatching, the young remain for six weeks in water among gravel, and then are fed with yolk of eggs and beef until the time when they are fit to be turned out to find their own food in more or less protected water. Sir James Gibson Maitland at Howiestoun rears 98 per cent. of the eggs treated. Jacobi in the 18th century tried artificial hatching in Westphalia, and John Shaw applied it to salmon on the Nith in 1837, while Remy and Gehin applied it to trout in France in 1841. In 1848 the French Government established a hatching-station at Huningue near Basel. The United States Commission of 1871 did much to advance the knowledge of the subject.

Pisgah, a mountain height of Palestine, is on the E. of the Lower Jordan, and commands an extensive view. From its top Moses is said to have viewed the Promised Land.

Pishin, a district of southern Afghanistan, N. of Quetta, and the point of junction of the roads from Candahar to the Punjab and Scinde. Its military importance made it a desirable object for Great Britain to gain, and since 1878 it has been under English management. The district contains 3,600 square miles, and is surrounded by mountain chains that in parts attain a height of 1,100 feet. Ranges of hills separate the valleys of the interior, through one of which a railway-line passes. The people, who are partly nomad, trade with India in horses, and cultivate cereals, maize, and melons.

Pisistratus (600–527 [?] B.C.), Tyrant of Athens, was in early life associated with Solon; but afterwards, in order to promote his schemes of personal aggrandisement, he put himself at the head of the Diacrii, one of the three factions into which Attica was divided. Having persuaded the Athenian people to grant him a bodyguard, he took possession of the Acropolis, and maintained his power for eight years (560–52), at the end of which he was expelled by the aristocratic party. After a period of exile in Eubœa, he returned to Attica in 541 and, after defeating his adversaries at Pallene, again made himself master of the city. After reigning peacefully for fourteen years, he was succeeded by his sons Hippias and Hipparchus. The rule of Pisistratus was at once firm and mild. He introduced useful social reforms, erected many beautiful buildings, and gave a great stimulus to literature by his concern for the arrangement and due recitation of the Homeric poems.

Pistachio (*Pistacia vera*), a small tree belonging to the terebinth family and native to western Asia, but now largely cultivated in southern Europe for the sake of its edible seeds. It has pinnate leaves of three or five leaflets, clusters of small apetalous unisexual flowers, and oval drupaceous fruits nearly an inch long, containing the bright-green kernel. These kernels are largely eaten by

Turks and Greeks, and now enter into French and even English confectionery.

Pistil, a somewhat ambiguous term, applied either to the gynæceum or entire female reproductive apparatus in a flower, or to the individual carpels in an apocarpous polycarpellary gynæceum. In the latter case each pistil consists of an ovary containing the ovules, a stigma to receive the pollen, and generally a style or column connecting the two. In this case, as in the buttercup or rose, a single flower may be furnished with numerous pistils. In the former case, though stigmas and styles may be distinct, as in grasses or carnations, the ovary may be united, and either one-chambered internally or with as many, or twice as many, chambers as there are carpels. [CARPEL.]

Pistoia, an Italian town in the province of Florence, near the left bank of the Ombrone and 20 miles N.W. of Florence, with which it is connected by a railway. It has lofty walls, squares, and good streets. The ancient cathedral is faced with white marble and has some valuable sculptures and paintings, and there is a church with a fine dome. Silks and woollens are manufactured, and pistols were first made here.

Pistole, an obsolete gold coin of Europe, was originally Spanish, and was adopted in Italy, Germany, and Switzerland. It used to equal in value a quarter-doubloon, and is now worth about 16s. 2d.

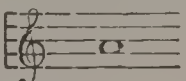
Pita, the Mexican name for the fibre obtained from the leaves of the larger species of *Agave*, the so-called Mexican aloes, and also from *Bromelia Pinguin* and *B. Karatas*, Central American plants allied to the pine-apple. The fibre is a valuable one, adapted for the manufacture of the best paper.

Pitcairn Island is in the South Pacific, lat. 25° 5' S. and long. 130° 5' W. It is 2½ miles long by 1 broad, with steep coasts bordered by reefs, with only one entry on the W. and one (Bounty Bay) on the E. It is chiefly noteworthy as being the refuge of the mutineers of the *Bounty* in 1790, and here in 1804 an American captain found John Adams, the patriarch of a Christian and English-speaking half-caste community. In 1856 the islanders, having become too many for the island, were transferred to Norfolk Island, but forty of them afterwards returned. In 1890 the inhabitants numbered 126, occupied in fishing, herding, and field-work, and cultivating potatoes, maize, yams, and fruits.

Pitch, the black, brittle, glossy solid residuum after the distillation of wood-tar. We import from 4,000 to 5,000 tons annually, chiefly from Russia and France. That made in England and Russia is the product of the Northern Pine or Scotch Fir (*Pinus sylvestris*). *Burgundy pitch* is obtained from the spruce (q.v.) (*Picea excelsa*).

Pitch, in acoustics, is that characteristic of a sound or musical note which depends on the number of vibrations per second of the sounding body. The greater the number of vibrations per second the higher is the pitch, and this would be popularly expressed by saying that the note was

shriller or more acute. Whenever two notes are of the same pitch—it matters not how they are produced—their rates of vibration are equal. If a singer and a tuning-fork produce the same note, the vocal cords of the one are moving to and fro in the same time as the prongs of the other. It is easy to determine the number of vibrations in any note by means of the syren (q.v.), or by choosing a tuning-fork which gives the same note and finding the number of vibrations of the tuning-fork in a special manner. [TUNING-FORK.] For use in tuning different musical instruments, it is desirable to have a reference standard of pitch. For this

the note *a'*  is usually chosen, but

unfortunately there is no universal agreement as to its value. In physics the note *c'* (the middle C on the piano) is generally taken as 256, which would give *a'* as 426.6. Concert pitch has been constantly rising. In the early part of the 18th century *a'* was 424, and organ pitch a hundred years ago used *a'* = 388. Whatever number is chosen for this fixes the value of all the other notes. In stringed instruments the pitch of a note depends on the length of the vibrating string, on the tension, and on the weight. In a violin, for instance, a finger placed so as to shorten the vibrating part of the string causes the production of a higher note. The heavier bass string gives a lower note on account of its extra weight. In wind instruments the note is produced by the vibrations of a column of air, the longer the column the lower being the note emitted; this is most simply exemplified by the pipes of an organ.

Pitchblende, a mineral found in Cornwall, Turkey, and other localities, which is interesting as being the chief ore and source of the metal *uranium* (q.v.). It consists of oxides of this element, possessing the formula U_3O_8 , but usually contains iron, silica, lead, and other substances as impurities, and is of a black and massive appearance, occurring in brilliant octahedral crystals (specific gravity, 9.35).

Pitcher-Plants, the isolated genus *Nepenthes*, belonging to the Indian monsoon region, and other plants (such as the Australian member of the saxifrage family *Cephalotus follicularis*, and the American Sarraceniaceæ) in which the leaf is modified into an *ascidium* or pitcher. Though varying in details, the pitcher generally develops by intercalary tubular growth, like a peltate leaf. In the Sarraceniaceæ it is sessile; in *Cephalotus*, shortly petiolate; in *Nepenthes*, furnished with a long and partly winged petiole. The apical part of the leaf-blade commonly forms a raised lid to the pitcher, and its margin is often strengthened by inrolling. Remarkable external flanges sometimes exist, and these and the mouth of the pitcher may be baited by honey-secreting glands. Internally the throat of the pitcher is generally smooth; but lower down are downward-pointing hairs and a surface studded with glands. Some of these glands excrete a neutral watery liquid. In *Nepenthes*, as soon as any insects or other nitrogenous matter has found

its way into this liquid, it becomes acid, digestive ferments (zymases) are discernible, and a true digestion takes place, resulting in formation and absorption of peptones. In the Sarraceniaceæ, though the liquid seems to have a remarkable asphyxiating effect upon insects, like oil rather than water, no digestion seems to take place, the leaf merely absorbing the liquid products of decomposition. In *Dischidia*, it would seem, the function is altogether distinct, water-storage rather than insect-eating being aimed at.

Pitch-pine, the most valued pine-timber of the United States, largely employed in American dockyards and exported in immense quantities to Britain, is the wood of *Pinus australis* (sometimes called *P. palustris*), the Georgia pitch-pine or yellow pine of the southern States, one of the group with three needle-leaves on each dwarf-shoot. It grows on the sandy "pine barrens" of Georgia, Florida, and Carolina, and yields much tar and turpentine as well as timber. Its bright-green needles are often a foot long. *P. rigida*, the pitch-pine of the northern States, with short dark-green needles, is more used for fuel.

Pitchstone, so called on account of its resinous lustre, is a glassy volcanic rock, agreeing in chemical composition with felsite (q.v.). It contains abundant microliths, and occasionally in cooling has developed that combination of rectangular and concentric shrinkage known as perlitic structure. Its average silica percentage is 70, and its specific gravity 2.3. It occurs in Arran, Eigg, etc.

Pith, the central conjunctive tissue of the root and stem, known technically as the *medulla*. It varies considerably in amount, being relatively largest in such underground structures as potato-tubers, in herbaceous stems, and in the elder. Its cells may become prosenchymatous; but seldom become sclerotic. They generally lose their protoplasmic contents at an early stage, and either shrivel up, or are ruptured by rapid elongation of the organ. Thus, in the centre of a sound oak stem the pith remains as a line of dust-like cells; whilst in the internodes of most grasses (straw, bamboo, etc.), and throughout the aerial stems of many herbaceous perennials among the Umbelliferae (q.v.) and Compositae (q.v.) it is so ruptured as to leave a hollow stem.

Pithom, a store city of the Pharaohs, built by the children of Israel, has been identified as underlying an Arab village half-way between Ismailia and Tel-el-Kebir, on the Cairo and Ismailia Railway and the Freshwater Canal. Excavation has shown it to be a square enclosed by a wall 22 feet thick, and measuring 650 feet each way. The enclosed 10 acres is divided by walls about 10 feet thick into chambers which were entered from above. A temple has been discovered, thought to have been built by Rameses, who would thus be the oppressor of the Israelites.

Pitman, ISAAC (b. 1813), originator of the system of shorthand which bears his name, was

born at Trowbridge. His first publication on the subject was *Stenographic Sound Hand* (1837). In 1842 he started the *Phonetic Journal*.

Pitré, GIUSEPPE (b. 1841), an eminent Italian writer on folk-lore, born at Palermo. His chief works are comprised in two series, *Biblioteca delle Tradizioni Popolari Siciliane* (19 volumes, 1870-91), and *Curiosità Popolari Tradizionali* (10 volumes, 1885-91).

Pitt, WILLIAM (1759-1806), second son of the great Earl of Chatham and Lady Hester Grenville, was born May 28th, 1759. He went into residence at Pembroke Hall, Cambridge in 1773, and in 1780 was called to the bar, and went the Western Circuit. His political career began in the autumn of the same year, when Parliament was dissolved, and he was elected for Appleby. His first speech was delivered in the following February, in support of Burke's scheme of Economical Reform, and made a deep impression on the House. In 1782 he refused Rockingham's offer of the Vice-Treasurership of Ireland, which was not a Cabinet office, and later in the same year joined Lord Shelburne's Ministry as Chancellor of the Exchequer and leader of the House of Commons. In February, 1783, Lord Shelburne was displaced by the Coalition, and when this Administration came to an end in December of the same year Pitt, being then in his twenty-fifth year, undertook to form a Ministry, although there was a majority against him of nearly two to one. So masterly was his conduct of affairs that by the beginning of March, 1784, the adverse majority had dwindled down to one, while in the country his policy excited vehement enthusiasm. He now dissolved Parliament, and found himself supported by a large majority. When the French Revolution degenerated into the tyranny of a sanguinary mob he placed himself at the head of the opposition to France. His war administration was not fortunate; but, in spite of this, his home policy was such as to preserve to him the confidence of the nation at large. Among the questions which he dealt with during his first premiership were electoral reform, which the opposition of George III. forced him to abandon; the government of India, in which he achieved a striking success; the reduction of the National Debt, and the revision of taxation and of trade duties; the impeachment of Warren Hastings, in which, however, he took no active part; the abolition of the slave trade, the Regency, and the parliamentary union of Ireland with England. It is impossible to defend the means by which Ireland was prevailed upon to part with her Parliament; but it is to be remembered in Pitt's favour that, if he was not superior to the employment of corruption as a means of government, he was personally incorruptible, although his financial affairs were deeply involved. As to the policy itself, it is impossible to judge it with certainty, since the obstinacy of the king prevented it from being fully carried out. An essential part of it, in its author's estimation, was Catholic emancipation; and, being unable to overcome the king's fanatical aversion to this, he in 1801 resigned, after having held office for seventeen years. For a time he was content

to support Addington, but when he saw that his successor's war measures were inadequate his attitude changed; and, as the consequence of his attacks, the Ministry resigned in 1804, and he was recalled. His aim at a time of national difficulty and danger was to form a Government which should include the best men of all parties; but the king's hatred of Fox was implacable, and he had to content himself with a Tory Ministry. His energy and resource in the crisis in which the nation now found itself were almost incredible; but his policy met with reverse after reverse. In April, 1805, the Opposition proposed a vote of censure on Lord Melville, the Treasurer of the Navy in his former administration, for mismanagement, and the carrying of the motion by the Speaker's casting-vote, in spite of Pitt's strenuous defence, was felt by him as almost a vote of no confidence in himself. At this time he was concluding a treaty with Russia to serve as the basis of another European confederation against Bonaparte, and when in August Austria joined the coalition and was followed by Sweden, his hopes of bringing his Continental policy to a triumphant issue rose high; but on the 19th October Mack, with thirty thousand Austrian soldiers, capitulated at Ulm, and the news was little less than a death-blow to Pitt, in spite of the glorious victory at Trafalgar two days later. His health was by this time sadly shattered, and early in December he went to Bath for rest and treatment. There it was that intelligence reached him of the overthrow of the Russians and Austrians at Austerlitz. This calamity was more than his broken health and spirits could bear. He travelled back to Putney in January for the opening of Parliament on the 21st, but was too ill to be present, and death came two days later (January 23rd, 1806). He was never married. At one time of his life he formed an attachment for Miss Eden, the eldest daughter of Lord Auckland, but his pecuniary embarrassments prevented him from prosecuting it, and the lady afterwards became the Countess of Buckinghamshire.

Pittsburg, a town of Pennsylvania in the central part of the West Pennsylvania coal-field, between the Monongahela and Alleghany rivers, occupies the site of Fort Du Quesne, taken by Washington from the French in 1758, the town which arose being named after William Pitt. Its position near the merging of the two rivers above-mentioned into the Ohio, and the fact of its being a great railway centre, give it great facilities for trade. The surrounding scenery is fine, and the use of a supply of natural gas for industrial purposes renders it almost free from smoke. There are fifteen bridges—some of them being suspension-bridges—and many good buildings. The coal seams in the neighbourhood are worked by means of adits, and the town is the chief centre in America of iron, steel, and glass manufacture. There are many blast-furnaces, rolling-mills, and foundries. The town owed its first success to the introduction of steam in 1811, and the development of the coal and iron industries rapidly raised it to a high position.

Pituitary Body. [BRAIN.]

Pityriasis, a form of skin eruption attended with bran-like desquamation.

Pius, the name of many of the Popes, the first to bear it being the tenth Bishop of Rome, who flourished between 142-157 A.D. The second Pius was Ænea Silvio Piccolomini, born in 1495. He was secretary to several bishops, and took the side of the council which deposed Eugenius IV., but afterwards supported him. He was successively Bishop of Trieste and Siena, and was made cardinal by Calixtus III., whom he succeeded as Pope. He tried to organise a crusade against the Turks, but failed, and the disappointment in this—one of his great projects—is said to have hastened his death. He wrote some valuable geographical and historical works. **PIUS IV.** (Giovanni Angelo Medici), who died in 1565, was elevated to the Papal see in 1560, and was a sagacious and temperate ruler, who instituted various reforms in the Church worship. It was during his reign that the famous Council of Trent was held. **PIUS V.** (Michele Ghisleri) became pope in 1566. He made ruthless war on heretics and Protestants, and issued a bull against Queen Elizabeth, which had no effect. He assisted Charles IX. of France to put down the Huguenots, and during his tenancy of the holy see the Inquisition was at its worst. He died in 1572. In 1775 Giovanni Angelo Braschi was chosen Pope, being then nearly sixty years of age. He tried hard to re-establish the Papal authority, which had been weakened under some of his predecessors, on its old basis, and disputed with Joseph II. of Germany as to Papal jurisdiction over his court. The French Revolution broke the close connection which had existed between the Papacy and France: 130 bishops and 60,000 clergy refused to recognise the new French constitution, and Louis supported them. A Frenchman having been killed in Rome, Bonaparte and the Convention threatened war, and in 1796 the Pope was obliged to agree to terms which condemned him to pay a large tribute and to yield up the northern Italian provinces. Later, fresh troubles led to the capture of Rome by the French and to his imprisonment, from the hardships of which he died in 1799, aged eighty-one. **PIUS VII.** (Barnabas Luigi Chiaramonti) was born in 1742, and was elected Pope in 1800, entering Rome after having made a concordat with France. He got back the Papal states in 1801, and was known for his mildness and wise moderation. He went to Paris with great pomp in 1804 and anointed Napoleon, and returned in 1805 without receiving, as he desired, any concession. He declined to acknowledge Joseph Bonaparte as king of Naples, which had been conquered, and in February, 1808, Rome was again retaken by the French. In spite of threatened excommunication, Napoleon united various Papal provinces to the kingdom of Italy. Pius was arrested and forced to practically renounce his claims, and when he retracted he was again arrested, and was not allowed to enter Rome until after Napoleon's fall. **PIUS IX.** (Giovanni Maria Mastai-Ferretti) was born in 1792, and had intended to adopt a military career, but finally decided on

entering the Church. In 1827 he became an archbishop, and in 1840 a cardinal. His election to the Papacy in 1846 promised well, as benevolence and goodness were strongly-marked characteristics of his. He reformed many abuses, and was prevented carrying out other improvements by the revolution of 1848. His minister, Count Rossi, was assassinated and even his own palace attacked, and he was forced to flee from Rome in disguise. A republic was formed at Rome in his absence, and this was replaced by French troops, who gained possession of the city in 1849 after a brief struggle, the Austrians meanwhile holding the northern provinces. In 1854 Pius promulgated the doctrine of the Immaculate Conception, and in 1869 opened the Vatican Council, which first affirmed Papal Infallibility as a tenet of the Catholic Church. The Sardinians, who had revolted, gradually overpowered the Roman states, and their king was appointed over them. The French, who had undertaken to defend Rome, were obliged to withdraw from it when the Franco-German War broke out, and Victor Emmanuel's troops entered the holy city. Pius retired into the Vatican, where he lived in seclusion till his death on February 7th, 1878. The removal of his remains to San Lorenzo was the occasion of many regrettable scenes of disorder. It was he who, in 1850, first divided England into Catholic dioceses.

Pizarro, FRANCISCO, the conqueror of Peru, was born about 1476 at Truxillo, in Spain. He was a natural son, and his early history is obscure; but it is known that his father was a soldier of distinction. He received absolutely no education and was never able to read or write, and enlisted as a soldier in order to give up his occupation as a swineherd. His courage and his wily manner speedily procured him promotion; and, his cupidity being as marked as his ambition, the conquest of Mexico by Cortez induced him to join with another soldier named Almagro, in 1524, in an expedition to Peru, of which little was then known. Pizarro had previously been on a voyage of discovery, as he was one of those with Balbao when the latter discovered the Pacific Ocean. The funds for the Peruvian expedition were provided by a priest named Luque. Save that it revealed a rich country and many possibilities of plunder, this expedition did not yield much profit, and the sufferings of those who undertook it were terrible. Another voyage was accomplished in 1526-27, and this time the tremendous importance of securing the country was fully recognised. Pizarro and his companions brought away much spoil, and were determined to seek the aid of the Government in their project, seeing how few they were in number and their lack of money. They first tried to get help from the Governor of Panama, who refused to assist them. Pizarro arrived in Spain in 1528, and obtained an interview with Charles V. at Toledo, unfolding his plans and expatiating on the results of a successful expedition to Peru. It was July, 1529, however, before he obtained the royal sanction. He was appointed governor of the territory to be annexed, which received the name of New Castile. Securing the

help of his brothers and other adventurers, Pizarro embarked in 1531 with three ships, leaving Almagro to follow with such help as he could get. At this time Peru was tormented by a civil war, which proved Pizarro's opportunity. The emperor had died, and his two sons were fighting for the throne. The victorious son, Atahualpa, did not recognise the seriousness of the Spanish invasion, nor the ease with which Pizarro's handful of men could be annihilated. Pizarro professed peace when the hostile forces met, and invited Atahualpa to a banquet, where he was arrested and his followers massacred. The butchery which followed was frightful. The Peruvians, utterly demoralised, were slaughtered in thousands. Pizarro forced Atahualpa to disclose all his treasure, and then ordered him to be burnt as a conspirator, but mercifully allowed him to be strangled first on his becoming a Christian. His cruelty so thoroughly subjected the Peruvians that Pizarro held his course uninterruptedly. He founded Lima in 1535, and but for his savage treatment of Almagro, whom he put to death, might have reigned for many years. He was created a marquis, but was assassinated with his brother on June 26th, 1541, by the friends of his murdered companion Almagro.

Placenta, a complete organ, formed partly from the inner walls of the uterus of the parent, and partly from parts of the foetus, by which the latter is nourished during its intra-uterine life. It is, in fact, a specially-modified secreting gland to which the blood-vessels of the foetus act as ducts. The placenta is characteristic of Mammalia; but varies considerably in development in the various subdivisions of the class. The term is by analogy extended to the spongy tissue from which the ovules spring in spermatophytic plants. [PLACENTATION.] This often serves also as a conducting tissue for the growth of the pollen-tube to the micropyle.

Placentation, the arrangement of the ovules on the soft spongy tissue known as the *placentas*. In a few cases a single ovule, or a placenta bearing several ovules, appears to be a direct prolongation of the floral axis, independent of the carpellary leaves which may form an ovary round it. This is termed *axial placentation*. It occurs in the solitary gymnospermous ovule of the yew (q.v.); in the similarly solitary *terminal* ovules of the reed-mace (*Typha*), the rhubarb tribe (*Polygonaceæ*), and the peppers (*Piperaceæ*); and in that in the inferior ovary of the walnut tribe (*Juglandæ*). In the Compositæ (q.v.) one ovule arises from the base of the inferior ovary; but it is lateral to the axis, the apex of which is visible beside it, so that the ovule is homologous to a leaf, as also in the gymnospermous *Ginkgo* and in the Primrose family, where the placenta bears several lateral ovules. In a few cases, as in water-lilies, poppies, etc., the ovules are produced all over the inner surface of the carpellary leaves. They are then termed *superficial*, and are generally somewhat rudimentary in structure, being probably homologous to trichomes. In the majority of flowering-plants the placentation is *marginal*, the ovules corresponding to lobes or leaflets of the

carpellary leaf. In most one-chambered ovaries the margins of the carpellary leaves form the spongy placentas and bear the ovules, often in double rows, each row belonging to one leaf-margin. This is termed *parietal placentation*. In Cruciferae (q.v.) we have the exceptional case of parietal placentation in a two-chambered ovary, the margins of the two carpellary leaves splitting, and one half growing inwards so as to form the partition or *replum*, while the other half bears the ovules. Many-chambered ovaries are so mainly from the infolding of the margins of carpellary leaves which form the *septa* or *dissepiments* between the chambers (*loculi*). In poppies and cucumbers this infolding is only partial; but in lilies, *Iris*, etc., these septa unite to form a *central* placenta which has been termed *axile*. In the pinks and other Caryophyllaceæ the septa are only distinguishable at the base of the ovarian cavity in the young stage, and this placentation, like that of the primrose family, has been described as *free central*.

Plagioclase, the collective name for those varieties of felspar (q.v.) that crystallise in the Anorthic system, including *microcline*, a potash felspar, *albite*, or soda felspar, *anorthite*, or lime felspar, and the intermediate forms *oligoclase*, or soda-lime felspar, *andesine*, or soda and lime felspar, and *labradorite*, or lime-soda felspar, which Tchernak regards as only isomorphous twin combinations of albite and anorthite.

Plague, a contagious disease accompanied by fever and the formation of *buboes* or glandular swellings. Plague has not visited this country since the time of the Great Plague of 1665. It has prevailed, however, from time to time in Egypt and Asia Minor, and has been met with occasionally in Russia. The disease is an eminently fatal one, and bears considerable analogy to the malady known as typhus fever, but does not present the characteristic rash of that disease.

Plaice (*Pleuronectes platessa*), a flat fish allied to the flounder, frequenting sandy and muddy banks off the northern coasts of Europe, often passing into brackish and even fresh water. The upper side is olive, spotted with orange; the under-surface whitish; but the general hue of the fish harmonises with that of the ground on which for the time it rests. Buried all but the eyes in sand or mud, it lies in wait for its prey—principally molluscs. Trawl-nets and lines are used for plaice, and the flesh is valued for the table. The average length is about a foot, with a weight of three pounds, but much larger specimens are recorded.

Plain Song, the old simple Church method of chanting, probably in unison and without harmony. The age of its introduction is uncertain, but it dates very far back, and the old notation does not throw very much light upon its nature. SS. Ambrose and Gregory introduced great changes, almost amounting to a new method.

Plaintiff, in law, the person who begins a suit to recover a claim against another person known as the *defendant*. If he fail to make out a legal case, he may be non-suited.

Planarians, a class of worms known as the Turbellaria (q.v.). They are, as a rule, fairly small, and always consist of only a single segment. The skin or ectoderm is covered with the small vibratile processes known as cilia. The nerves consist of a pair of long cords passing back through the body from a pair of masses or ganglia at the front end of the body; in one group, the Acœla, the nerves are usually absent. There is a mouth, but no anus. They are nearly always hermaphrodite, but the male organs usually mature before the female. The class is divided into two divisions. The first, known as Rhabdocœlida, are small, and the intestine is either lobed, straight, or absent; the second, or Dendrocœlida, have a greatly branched intestine, and are large in size. The Planarians are carnivorous, and a few are parasitic, such as *Anoplodium* on the Sea-cucumbers. They live either in the sea, e.g. all the Polycladida and Acœla, in fresh water, such as *Plagiostoma*, *Planaria*, etc., or on damp earth, such as the land Planarians, e.g. *Bipalium*. As they are soft-bodied, no fossil representatives are known.

Planché, JAMES ROBINSON (1796–1880), antiquary and dramatist, was born in London. He became a noted heraldic writer and authority on costume, and was appointed Somerset Herald in 1866. Besides a great number (nearly 200) of burlesques, he wrote many other works, of which the most valuable are *History of British Costume*, *Regal Records*, and *The Pursuivant at Arms*. His interesting autobiography appeared in 1872.

Plane, in geometry. From experience we get the idea of a plane as a flat surface which can be extended to infinity in all directions. If we take any two points and pass a plane through them, we can turn this plane about the line joining the two points till it passes through another point. The plane is now fixed; hence, through any three points in space, one, and only one, plane can be drawn. Euclid defines a plane as that in which any two points being taken, the straight line joining them lies wholly in that plane. This is the same as saying that it has no curvature. It is, therefore, the limiting case of a sphere when the radius has become infinite. Two planes intersect in a straight line, and their inclination to each other is measured by the angle between two lines—one in each plane—drawn perpendicular to the line of intersection. When the planes are perpendicular to each other, this angle is a right angle. Any plane divides the whole of space into two parts.

Plane (*Platanus*), the sole genus in the somewhat isolated order of Incompletæ (q.v.), the Platanaceæ, comprising five or six closely-allied species, trees native to the extra-tropical regions of the northern hemisphere. They throw off their outer bark in squarish scales; and their large leaves, which are scattered, stipulate, stalked, and palmately-lobed, have a polished upper surface. These two characters render them specially suitable for growth in the soot-laden atmosphere of our large towns. The axillary buds are concealed within the dilated base of the leaf-stalk. The flowers are

monœcious and hang in separate globular catkins, whence the trees derive their American name of Button-woods. The female flower may have from four to eight distinct carpels, each containing one or two pendulous ovules, but forming a one-seeded achene. The timber is smooth-grained, prettily marked, white or dull red, and susceptible of a high polish. It is used in carpentry and cabinet-making; but the trees are chiefly valued for their shade. In Scotland the Great Maple or Sycamore (q.v.), the white wood of which is largely used for small articles of turnery, is called Plane. It is distinguished by its smooth bark, opposite leaves, loose racemes of flowers, two-winged fruits, and unfigured wood. The Oriental Plane (*P. orientalis*), the Maltese or Maple-leaved Plane (*P. acerifolia*), and the Occidental Plane (*P. occidentalis*) seem little more than geographical races.

Planet (“a wanderer”) is the name given to each of the bodies in the solar system, these bodies all moving in elliptical orbits with the sun in one focus. They received their name, on account of their motion, to distinguish them from the fixed stars. Although their movements can be so simply explained, they appear to be extremely irregular, and were a source of great difficulty to the ancient astronomers, who invented many theories to explain them. The planets, in the order of their distances from the sun, are Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune, the planetoids occurring between Mars and Jupiter. Mercury and Venus are known as *inferior* planets, the others—those which are farther from the sun than the Earth is—being called the *superior* planets. When a planet and the sun are on the *same* side of the Earth, the three being in the same straight line, the planet is said to be in *conjunction*—inferior or superior, according as the planet or sun is nearer the Earth. When planet and sun are on opposite sides of the Earth, the planet is in *opposition*. The time between two successive conjunctions or oppositions is called the synodic period of the planet, and this is useful in calculating the relative distance of Earth and planet from the sun, and in determining the planet’s periodic time (q.v.). The orbits of all the planets (except the planetoid Pallas) are very nearly in the plane of the ecliptic, the intersections of the plane of the planet’s orbit with the ecliptic being called nodes. When an inferior planet is near one of these nodes at inferior conjunction, it looks like a dark spot on the sun’s surface. This and other appearances show that the inferior planets are not self-luminous, but receive their light from the sun. Viewed through a powerful telescope, they are seen to exhibit phases similar to those of the moon, being sometimes crescent-shaped (near inferior conjunction), sometimes halved, sometimes gibbous, and, at superior conjunction, exhibiting a full bright disc. The superior planets appear practically with a full bright disc, Mars alone being somewhat gibbous at part of his course. The planets always appear, when seen, to shine with a steady light, thus differing from the twinkling stars; this gives a means of roughly distinguishing them in the sky. Several of the

planets are accompanied by satellites or moons, these bodies revolving round the primary in the same way as the moon circles around the earth. Since the orbits of the planets are in most cases not far removed from the plane of the ecliptic, they are to be seen in a comparatively narrow belt of the heavens. The motions of the planets are in accordance with Kepler's Laws (q.v.); hence, the interior planets take far less time to revolve round the sun than the exterior ones—the periodic time increasing the farther away the planet is from the sun. The motion of a planet is not strictly uniform; it moves faster when at perihelion than at aphelion, and those planets whose orbits are most eccentric (*i.e.* differ most from circles) show the greatest difference between their quickest and slowest rates.

Plane Table. [SURVEYING.]

Planetary Motion. [PLANET.]

Planetoids are the very small planets which have their orbits between those of Mars and Jupiter. They escaped discovery till quite modern times, but ever since their existence was first shown to be probable on theoretical grounds, they have been discovered in increasing numbers. The greatest number has been found since 1845, owing doubtless to improved instruments and methods of search. The inclination of the orbits of these bodies to the plane of the ecliptic varies considerably, that of Pallas being as much as $34^{\circ} 42'$; and their eccentricities are much greater than those of the planets proper. Their motions among themselves are extremely irregular, the paths interlacing in a most intricate manner. Being so extremely small, it is almost impossible to ascertain their size; but it is believed that the largest is less than 450 miles across, while Leverrier considered that the sum of all their masses would be less than one-third that of the earth. The first five planetoids which were discovered were Ceres, Pallas, Juno, Astræa, and Vesta. It was once believed that the planetoids were portions of some planet, but the idea was not held for very long.

Planimeter is an instrument by means of which the area within any closed curve can be practically measured. Several devices have been introduced for this purpose, one of the simplest being Amsler's planimeter. This consists of two arms, O J, T W, jointed at J and capable of moving quite freely in one plane. The end O of one arm is fixed, while the extremity T of the other arm can be made to exactly move over the curve whose area is required. The arm T J passes through the centre of a wheel W, and serves as its axis of rotation. The revolutions of the wheel measure the area traced out by the point T, and are independent of the position of the wheel on its axis, T J. However the tracing-point may move, its motion can be resolved into two components: one along the arm T J, and the other at right angles to it. It is obvious that the first will not cause the wheel to rotate; hence the wheel only records the motion which is perpendicular to its axis. After T has traced out the entire curve, the arms will obviously return again to their original position. It can then

be mathematically proved that the area of the curve is equal to $TJ \times S$ where S is the length recorded by the wheel.

Planisphere is a projection of a sphere on a plane. The name is practically applied to a device for ascertaining which stars will be visible on any given night. A chart of the heavens is fitted so that it can rotate under a cardboard cover, through a hole in which a portion of the chart can be seen. The days of the year are indicated by marks on the edge of the chart, and by means of these the relative positions of it and its cover can be adjusted so that the stars which appear through the opening are those which will be visible on that night. Some stars—such as the Pole Star and the Constellation of the Great Bear—will always be visible, but those near the horizon will change from day to day.

Planorbis, one of the commonest genera of pond-snails. The shell consists of a flat, disc-shaped coil.

Plantagenet, the surname of some of the kings of England. The first king of the name was Henry II., and the last Richard III. It rose through Fulk, the first Earl of Anjou, being scourged in Jerusalem, with twigs of the broom which grew profusely there. He bore this as a penance, and called himself Plantagenet from the incident. The golden broom is the emblem of the family.

Plantain (*Plantago*), a name given originally to various plants with broad leathery leaves. In England it applies to the species of the genus *Plantago*, common weeds. *P. major*, with ascending leaves, a plant of waste places and road-sides, produces long spikes of fruit, which, when unripe, are collected as food for cage-birds. *P. media*, with mealy, flatter leaves and violet bracts to its shorter flower-spike, is even more troublesome as a weed on lawns, especially on limestone. *P. lanceolata*, a meadow-plant, has short black-bracted spikes of flowers on long peduncles. In the tropics the name is applied to that race of the bananas which have a green stem without purple spots, and a yellow angular fruit only edible when cooked; but the plant is not a distinct species from *Musa sapientum*, the banana (q.v.).

Planté Cell. [CELL.]

Plantigrada. [CARNIVORA.]

Plantin, CHRISTOPHER (1514–89), eminent Belgian printer, born, at Mont Louis, of French parentage. He started business as a printer at Antwerp, and also established branches at Leyden and Paris, and produced some fine specimens of typography. His greatest production, known as *The Antwerp Polyglot*, appeared in the city after which it is named. There is a monument to his memory in the church of Notre Dame, Antwerp.

Plant-Lice. [APHIDES.]

Planula, a free-swimming embryo which is rather characteristic of the Coelenterata. It differs from a blastula mainly by being ciliated. It becomes fixed, loses its cilia, and develops into the "hydranth" or polype tube of the adult form.

Plasmodia are irregular, formless aggregations of protoplasm, which occur among many of the simpler Protozoa. The most typical examples, however, are met with among some low organisms which are generally regarded as plants, such as the "Fission-Fungi" or Myxomycetes and the bacteria of malarial fevers.

Plaster of Paris, a cement obtained by heating gypsum (q.v.) for some time to about 120°C . It consists of anhydrous sulphate of calcium CaSO_4 , and if mixed with water, sets to a hard mass owing to the combination of the two substances, heat being evolved by the action.

Plasticity is a property possessed by solids which are capable of being moulded. Thus lead can be moulded into bullets without being first melted, and it is to the plasticity of clay that the potter's art owes its origin and developments. To explain the motion and behaviour of glaciers, ice was assumed to have the property of plasticity. This view was first put forth by Bordier of Geneva in 1773, and in 1841 Rendu founded a theory of glaciers on the same basis. He points out the fact that many observations seem to show that "glacier ice enjoys a kind of ductility which enables it to mould itself to its locality, to thin out, to swell, and to contract as if it were a soft paste." This theory of plasticity was later termed by Forbes the "viscous theory" of glacier motion. This theory has found many supporters, for ice has been shown in many cases to exhibit the property of plasticity in a striking manner. On the other hand, our ordinary experience of the extreme brittleness of ice has made it difficult for many to accept the idea.

Plastids, differentiated portions of the protoplasm in a cell (q.v.). Like the nucleus (q.v.), they are not formed *de novo*, but multiply by division. Though various in form, they seem uniformly to consist of a ground-substance of the proteid *chloroplastin*, with imbedded fibrils of the colourless proteid *metaxin*. The plastids themselves may be colourless (*leucoplastids*), green (*chloroplastids* or *chlorophyll-granules*), or otherwise coloured, generally red or yellow (*chromoplastids*); but under certain conditions these forms are interchangeable.

Plataea, in Bœotia, was the scene of the defeat of the Persian general Mardonius, who had been left behind with a large army by Xerxes, at the hands of Pausanias and Aristides in 479 B.C. The Plataeans also fought at Marathon and, siding with Athens in the Peloponnesian War, underwent a two years siege by the Thebans and Lacedæmonians in 429 B.C. and the following year. Their surrender was followed by a massacre and the destruction of the town, which did not recover its prosperity till after the battle of Chæronea.

Plate Glass. [GLASS and GLASSMAKING.]

Platinotype is one of the most simple, permanent, and beautiful of the processes used for printing photographic pictures from negatives. [PHOTOGRAPHY.] The paper employed consists of paper coated with a solution containing the bichloride of platinum, a *platinous chloride*, PtCl_2 , and ferric oxalate. It has to be kept carefully and

perfectly dry, otherwise it deteriorates and becomes useless. When exposed to light under a negative, the ferric salt changes in those parts where the light acts, and a faint image is seen on the paper. By the depth of this image, the completion or sufficiency of the exposure may be estimated, or an instrument known as an *actinometer* may be employed for the purpose. The paper is then floated in a solution of potassium oxalate, when by the reaction of the ferrous and platinous salts, platinum is formed in the paper, and this constitutes the image. The paper is washed in dilute hydrochloric acid to get rid of the unchanged salts, and then in water to get rid of the acid. The prints so obtained are then dried, and form pictures in pure black-and-white with a matt—i.e. not a glossy surface—which appear to be absolutely permanent. By a slight variation of the process sepia tones may be obtained.

Platinum (Pt 194.3), a metal of comparative rarity, which occurs in nature in a free or uncombined state (usually in small metallic grains), in gold sands and alluvial deposits. The natural metal is, however, impure, containing also iron, palladium, and other rare metals of the same group of elements. It occurs chiefly in the Urals, California, Borneo, Brazil, and Australia. The preparation of pure solid coherent platinum from the native metal is a matter of some difficulty owing to its great infusibility. It can, however, be melted by means of the oxyhydrogen flame. In the *wet* methods the native metal is subjected to the action of various solvents, and, by a complicated series of actions, platinum in the form of a black powder is obtained, which is afterwards welded or melted and cast in ingots. The melting is done in a lime crucible enclosed in a small lime furnace and heated by the oxyhydrogen flame. A *dry* method is also used in which an alloy of platinum and lead is first obtained, from which the platinum is obtained by *cupellation*, the alloy being strongly heated, so that the lead is oxidised and removed, the platinum remaining and being, as before, cast in ingots. It thus forms a silver white metal of very high density (specific gravity = 21.5). It is very malleable and ductile, while it can also support a great tensile stress. It is not acted upon by moist air, and does not oxidise. It is very infusible, and can be heated strongly in air without undergoing any alteration. It also withstands the action of most inorganic liquids, acids, etc. It is hence very useful for chemical apparatus which requires to be carried to a great heat or to contain corrosive liquids. In this way it is much employed for crucibles, evaporating basins, stills for concentrating sulphuric acid, and apparatus for hydrofluoric acid (which acts upon glass), etc. It possesses only a slight expansibility by heat, and can be fused through glass without the latter cracking when cold, and is much used for this purpose. If alloyed with iridium, the metal is still harder and less fusible. In a finely-divided state it forms a black powder known as *platinum black*, closely resembling lamp-black in appearance. This form of the metal possesses the remarkable power of absorbing certain gases—e.g. oxygen, which it appears to condense within it. It may thus absorb

250 times its volume of oxygen. Probably owing to this is also its property of effecting the union by mere contact of certain gases, oxygen and hydrogen uniting in the presence of platinum black. A form of platinum, also known as *spongy platinum*, is capable of inducing these *catalytic* syntheses. It forms a series of salts, the *platinous* and *platinic*, as *e.g.* platinous chloride, PtCl_2 , and platinic chloride, PtCl_4 . This last is the most important of its salts, and is largely employed in chemical laboratories.

Plato (429–347 B.C.), the great Athenian philosopher, was born at Athens in all probability, though it has been said Ægina was his birthplace. His father was Ariston, a descendant of Codrus, and his mother, Perictione, whose family claimed descent from Solon. He was named Aristocles, receiving the name of Plato later, probably from Socrates, in consequence of his broad brow or his fluency of speech; it is difficult to say which. In early life he began to write poems and to study philosophy. He burned his poems and became a disciple of Socrates at the age of twenty, and devoted himself most closely to that sage for ten years. He attended his trial, and after the drinking of the fatal cup (399 B.C.) was obliged to betake himself to Megara, where he stayed with Euclid, who had formerly been one of Socrates' disciples. He then went to Cyrene, and studied geometry under Theodorus, and for some time travelled in Egypt and in southern Italy, where the Pythagoreans still retained some influence. On his return to Athens he taught philosophy in the grove of Academus, giving his services without fee or reward, and soon attracted a large concourse of pupils, among them being Aristotle, and probably Demosthenes. At this time he had many great contemporaries, among them Xenophon, Aristophanes, Thucydides, Euripides, Sophocles, and Praxiteles. In his fortieth year, according to somewhat doubtful testimony, he visited Sicily, where he incurred the anger of the tyrant Dionysius by the expression of political views obnoxious to that personage. He had a narrow escape from death, and was shipped as a slave to Ægina to be sold in its market-place. He was bought by a Cyrenaic philosopher named Anniceris, who set him at liberty, and he returned to Athens, and with the exception of two visits in later life to the younger Dionysius, stayed there during the remainder of his life. He never married, and took no part in public affairs of any kind. His grave and melancholy aspect gave rise to the saying "As sad as Plato." He died at the age of eighty-two. For a long time his birthday was observed as a festival. His works have been handed down to us complete, and consist of dialogues, in which form of literary composition he has been almost without an equal. Into these dialogues he has often introduced Socrates, and from them we get much of our information about that great philosopher. According to some modern writers, Plato foreshadowed all modern philosophy, and it has been declared that all modern thought has been anticipated by him. Of his greatness there can be no doubt. He sought only truth, and enunciated many noble doctrines. He founded no system, but

his services to philosophy are not the less lasting. He divided it into its three parts, which he called dialectics, physics, and ethics, and in the first of these was a master. Dialectics, or the science of ideas, was his strong point. He held that not sensations, but ideas, determined our knowledge. The former merely inform us of the existence of things, but do not explain in the least. He urged this fact most strenuously, and directed it against the sophists, who, thinking man is merely a bundle of sensations, came to the conclusion that to let the senses have their full enjoyment was the chief end of man. Selfishness became in that way the greatest of all personal rights. Plato in his *Republic* combated this doctrine, holding that virtue was not an imaginary quality, but a reality. He is by no means so clear and cogent in his references to physics; but, after all, his ethical teaching is the most important. He taught the immortality of the soul, and said that the true philosopher should always be prepared for death, as that was not the end. He held that the soul was incarnate, and to the ancients the Socratic dialogue known as the *Phædo*, in which he insists upon its immortality, was the best of all his works. It is known that Cato read it just before depriving himself of life. Plato believed firmly in the value of analysis, of inquiry, of questioning the unknown, but he did not depend upon it absolutely. The genuine seeker after truth must have an inherent or intuitive reason, and must recognise those forces of Nature which are not entirely evident to the senses. The idea differs from the sensation in its being that which *is*, as opposed to that which merely *seems*. It will be seen that Plato begins with an assumption, and that no one will be convinced of the immortality of the soul who fails to perceive that it is a kind of instinct. Those who have died in the belief, however, as has been well said, had the instinct. Plato argues that nothing whatever can be thought or acted without some kind of assumption, and that this assumption necessarily lies at the root of all moral action. Plato's style is as fine as any in Greek literature, and though frequent attempts have been made to render his works into equally good English, they have hardly succeeded. Grote was one of the greatest of the expounders of Platonic philosophy, and among later scholars the name of the late Professor Jowett must be mentioned. His translation of the *Dialogues* is considered masterly. The first complete translation into English was that by Taylor and Sydenham, published in 1804.

Platt-Deutsch, a term applied to the dialects of the North German and neighbouring lowlands, and formerly extending from Holland to Russian Poland, and touching the borders of Denmark upon the N. The *Heliand* (a production of the 9th century) marks its first period, while the immediately succeeding period is poor in literature. Reincke Fuchs and the Flemish *Uilenspiegel* may be classed as Platt-Deutsch. In the 16th century it was employed in history and theology. Klaus Groth and Fritz Reuter have given much impetus to the modern Low German.

Platte. (1) A county of Missouri, United States of America, having Platte city as its capital. (2) A county of Nebraska, United States of America, the capital of which is Columbus.

Platte, LA, a river of the United States formed by the confluence of the North and South Forks, near Fort MacPherson, in Nebraska. It then flows east through that territory till it joins the Missouri near Platte city, after a course of about 1,000 miles.

Platycrinus, the type-genus of the *Platycrinidae*, an extinct family of Crinoids or Sea-lilies. Their remains are abundant in the limestones of the Carboniferous period.

Platyelmia, a group established for the "Flatworms" which belong to the three classes of the Turbellaria or Planarians (q.v.), the Trematoda (q.v.), and Tapeworms or Tæniada (q.v.).

Platypus. [ORNITHORHYNCHUS.]

Plauen, a town in the circle of Zwickau, Saxony, about 60 miles S.W. of Leipsic, on the White Elster river. It has a royal castle, a gymnasium, and factories for the weaving of muslins, jaconets, cambrics, and other cotton and linen goods. Paper and leather are also made.

Plautus, Latin poet, whose real name is said to have been Titus Maccius, was born about 254 B.C. at Sarsina in Umbria. Nothing is known of his early life, except that he was of humble origin and went to Rome while still a youth. There he remained for some years in obscurity, occupying various menial positions. He became known to some of the Roman actors, and began to write for the stage. He borrowed his plots from the Greek as a rule, but the exact extent of his obligations to them is not known, nor can it be discovered how he came to know Greek so well as he did. His plays were most successful, and won the highest praise from his contemporaries. Cicero admired them greatly; and Horace's disparagement is the sole exception to the universal chorus of eulogy which the best of the pieces received. He continued to write for the stage for forty years, producing such masterpieces as the *Aulularia*, *Menæchmi*, *Captivi*, *Miles Gloriosus*, and *Amphitryon*. Most of these have been copied or adapted by many modern writers, and even Shakespeare was indebted to him; but the French dramatists—and notably Molière, Regnard, and Destouches—were especially his debtors. Of his hundred or hundred and thirty comedies only twenty have survived. They were first printed at Venice in 1472, and since that date have been reprinted and edited and translated into different languages numberless times. Plautus died in 184 B.C. His plays are vivid satires on the manners and follies of his time, and were very popular with the people of Rome.

Playfair, JOHN (1748–1819), Scotch mathematician, was the son of a clergyman, and was successively professor of mathematics and of natural philosophy in Edinburgh University, and became president of the Royal Society of Edinburgh. He published an edition of Euclid and other valuable

works, which are still in use, and was known as an excellent geologist. There is a monument to his memory on Calton Hill, Edinburgh. His brother WILLIAM (1759–1823) was an ingenious inventor.

Plea and Pleading. A plea or pleading is a mode of putting forward a defence to certain proceedings. Pleadings in civil actions are now very much curtailed by the Judicature Acts; and by one of the orders made thereunder it is provided that "every pleading shall contain only a statement in a summary form of the material facts on which the party pleading relies, but not the evidence by which they are to be proved, and shall, when necessary, be divided into paragraphs numbered consecutively."

Plebiscite, a word coined under the rule of Napoleon III. to denote the popular vote which confirmed him in the Empire and seemed at various times to show that his ascendancy was popular with the nation. The name is taken from the Roman *plebiscita*, which were determined by the people voting by *tribes* and not by *centuries*.

Plegetopoda, the subphylum of Protozoa (q.v.), including those which are provided with various forms of vibratile processes, whereby locomotion is effected and food obtained. These processes are either in the form of numerous minute hair-like structures or cilia, longer and coarser whip-like appendages or flagellæ, or as membranes. There are three classes—viz. Tentaculifera (q.v.), Infusoria (q.v.), and Mastigophora (q.v.), of which the second is the most important.

Pleiades, a group of stars occurring in that belt of the heavens called the zodiac, being those placed on the shoulder of Taurus. For the last weeks in May the Pleiades rise and set with the sun, so are invisible to us; but 2,000 years ago it was during the time corresponding to our April that they were not seen. After May the Pleiades rise every day earlier and earlier than the sun, till in August they have gained about 90°. During November they can be seen the whole night through, but after that the time during which they are visible gets less and less till May comes round again.

Pleistocene System, the most recent of the geological systems, including what are known as *Superficial Deposits*, resting sometimes conformably on the Crag, but generally unconformably on strata of any age, and containing molluscs all of which belong to living species. Some geologists remove them from the Tertiary under the name *Quaternary*, mainly because in them alone are found remains of man and his works. Two series are commonly distinguished: the Lower or *Glacial*, containing many extinct mammals and others now living in distant regions [GLACIAL PERIOD, BOULDER-CLAY]; the Upper or *Recent*, containing few (if any) extinct mammals. Human remains or implements have been found in river-gravels, brick-earths, peat-mosses, lake-mud, cave-deposits, raised sea- and river-beaches, and shell-mounds or kitchen-middens, associated with the extinct mammoth (q.v.), *Machærodus* (q.v.), and Irish deer (*Cervus Megaceros*). The gigantic Kangaroos (*Diprotodon*)

of the Australian caves, and the sloths [MEGATHERIUM] and armadilloes [GLYPTODON] in the river-deposits of Argentina, are probably as recent as the beds containing human remains in Europe. [ANTIQUITY OF MAN.]

Pleochroism, the variation in colour observed when some crystals are seen from different points; this is due to the fact that the rays which have varying vibrations in different planes, suffer absorption in varying degrees.

Plesio-poritidæ, a family of corals of much interest, as they are intermediate in character between the two great groups of the Fungida and the Perforata.

Plesiosaurus, a genus of the extinct reptilian group, the Plesiosauria, including numerous species, some of which reach a length of twenty feet. It occurs from the Lower Lias to the Chalk; but allied forms are found in the Trias. The head is comparatively small, with one occipital condyle; nostrils far back; slender, curved, sharp, striated teeth, in distinct sockets, unlike *Ichthyosaurus* (q.v.); and without sclerotic plates round the eye. The neck is long and slender, and the tail proportionately short; but there are in all sometimes more than 90 vertebræ. The fore and hind limbs are very similar, longer than in *Ichthyosaurus*, but modified as swimming flippers. There are only five rows of digital phalanges. Though very perfect skeletons have been found in the Lias, there is no evidence of scales or scutes. The genus is represented in Britain, on the Continent, in India, Australia, and North and South America.

Plethora was the term applied by old medical writers to the condition in which they supposed there was an excess of blood in the body. The expression is still sometimes used to denote the habit of body in which there is a florid complexion with distended capillaries of the face, a tendency to hæmorrhage, and it may be a disposition to over-indulgence in food and alcohol.

Pleurisy, inflammation affecting the pleura, the serous membrane covering the lungs and chest walls. The disease may be excited by exposure to cold, or arise from injury, or be associated with tubercular or malignant disease, or arise in the course of certain fevers or in association with kidney or heart mischief. The chief symptoms are pain in the side, aggravated on taking a deep breath, fever, cough, and difficulty of breathing. Two varieties of pleurisy are described: *dry pleurisy* and *pleurisy with effusion*. In the former case the inflammation is accompanied by the formation of lymph, constituting what is called false membrane, and the rubbing of the diseased pleural surfaces against one another produces the characteristic "friction sound" which is heard in this condition on auscultation of the chest. In pleurisy with effusion, serous fluid is effused and accumulates in the pleural cavity, the underlying lung becomes compressed and collapsed, and on physical examination of the chest certain characteristic signs are discoverable. There is usually dulness on percussion up to the level at which the fluid

stands, the breathing sounds are faint, and sometimes what is known as *ægophony* is heard by the auscultator when the patient speaks. When the effused fluid becomes purulent, the condition of *empyema* is said to exist. Treatment consists mainly in maintaining rest in bed and applying counter-irritation to the affected side. If the effusion develops to such an extent as to embarrass respiration, it may be necessary to remove the fluid by the operation of *paracentesis* or tapping the pleural cavity. In the case of *empyema* this operation may also be sufficient; but it is usually found necessary to make what is called a free opening, with the object of draining the pus-containing cavity.

Pleurobrachia, a genus of Jellyfish belonging to the class Ctenophora (q.v.) and the type of the family *Pleurobrachiadæ*. The body is egg-shaped, about an inch in length, and has a pair of long tentacles which stream back behind. It is transparent and gelatinous. The genus is common in estuaries on the south and east coasts of England.

Pleurodynia, neuralgia affecting an intercostal nerve.

Pleuro - Pneumonia, a highly-contagious malady which affects horned cattle; the chief symptoms are fever, with difficulty of breathing, accompanied by inflammatory mischief affecting the lungs and their covering membrane. The disease may prove fatal in two or three days, but its course is usually more protracted. It is probably due to a micro-organism.

Plevna, a fortress in Bulgaria near the river Vid, 27 miles N.W. of Nicopolis. It was taken by the Russians July 6th, 1877, but retaken a few days later by Osman Pasha and held by him until December. Todleben at last invested the place, and the Turks were compelled to lay down their arms.

Plica Polonica, a disease of the hairy scalp met with in Poland, and said to be due to a fungus.

Plimsoll, SAMUEL (1824-93), known for his labours on behalf of English seamen, was born at Bristol and educated at Penrith and Sheffield, and was in early life a solicitor's clerk. He afterwards became clerk and subsequently manager of a brewery, on leaving which he started in business for himself. Being anxious to serve the seafaring classes, and having frequently observed that the sailors' lives were constantly jeopardised by ship-owners sending out rotten hulks, he entered Parliament as a Liberal in 1868, and between that year and 1880, when he retired from parliamentary life, worked hard to reform the Shipping Acts, and with complete success. His public exposure, in speeches and writings, of the owners' indifference to the lives of their crews, created a deep impression and won the public to his side.

Pliny, THE ELDER (Caius Plinius Secundus) (23-79 A.D.), ancient naturalist, was born at Comum, and was educated at Rome by excellent teachers. When twenty-three years old he went to Germany as a soldier with Pomponius Secundus, and during that campaign began his career as a

writer, one of his works being a history of the German wars. On his return to Rome he studied law, and became an advocate. Previous to Nero's death he was procurator of Spain, and by Vespasian was made commander of the fleet. In the year 72 he adopted his nephew, the YOUNGER PLINY (Caius Cœcilius Plinius Secundus). His desire for knowledge of the wonders of Nature was so intense that he would undergo great privations and sufferings to learn the smallest fact. He began to write his greatest work, the *Natural History*, and devoted years to the collection of material. He was a wonderfully industrious writer and an omnivorous reader, and most of his knowledge came from his close study of the ancient writers. In 79 the terrible devastation occurred which overwhelmed Pompeii and Herculaneum, and Pliny lost his life in his curiosity and thirst for information. Wishing to observe the phenomenon nearer, he went to Stabiae and made as many notes as he could of the catastrophe, but was suffocated by the noxious vapours from the crater. This occurred in the first year of Titus's reign. His work is in thirty-seven books, and contains most minute and interesting material about geography, natural history, astronomy, meteorology, mineralogy, botany, zoology, etc. There is much that is absurd and ridiculous as well as exceedingly valuable in his compilation, which is written in an admirable style. He derived most of his material from about one hundred authors and two thousand volumes. His nephew, already mentioned, was born in 62, and, after receiving a thorough education, became an orator and tribune in Syria and prætor in Rome at the age of thirty-one. He refused to serve under Domitian, but accepted a consulship later from Trajan, and shortly after the year 100 was appointed pro-consul of Bithynia. He died in 110, leaving a good reputation for learning and character. His most important productions are his *Epistolæ* or *Letters*, which are classics. They give very valuable information about his period, and those to Trajan describe the progress of Christianity and are of the highest importance.

Pliocene. [CRAG.]

Plotinus (205–70), Greek philosopher, was born at Lycopolis, in Egypt. His antecedents are unknown, as he would never name his parents, so impressed was he that he owed them nothing for bringing him into the world, which, from his standpoint, was a cruelty. He went to Alexandria when twenty years old, and studied philosophy under famous masters. He accompanied the Emperor Gordian to Mesopotamia when he was approaching forty, intending to study the Persian and Indian doctrines; but the assassination of Gordian, who proposed to invade Persia, frustrated his desire, and he escaped to Antioch and thence to Rome, where he taught what is known as the Alexandrian philosophy, attracting many pupils, among them being Porphyry and Longinus. His system is the Neo-Platonic and Eclectic, being a revival of Plato's, and teaches the cultivation of thought, the avoidance of selfish passions, and the seeking of truth above all. After his death at the age of sixty-five, Porphyry collected his works. His last words

were: "The divine in me is about to join that which is divine in the universe."

Plough, one of the best-known and universally-used instruments of agriculture, though much changed from its primitive formation, still retains its original essential features. It appears to date from the first period at which man conceived the idea of utilising a second person—whether human or not—to aid him in turning up the ground. The earliest form of plough seems to have been a forked bough, a short and sharpened end of which was drawn through the ground, while a kind of handle fixed in the rear enabled someone to guide it from behind. Such a plough was in use in ancient Egypt, and was early introduced into Greece, while the Romans were not slow to produce a much more elaborate contrivance. The Roman plough is very fully described by Virgil in his *Georgics*. The essentials of the plough are—(a) the beam to which the horse is fastened, and which is lengthened backwards into one handle, to which the other handle is attached at an angle, and fastened by one or more cross-pieces; (b) the coulter, a vertically-fixed blade which cleaves the earth in a perpendicular direction; (c) the share, which cleaves it in a horizontal direction; (d) the mould-board, which turns over the excavated soil. Few implements have undergone more improvements, some of which are the substitution of iron for wood and the addition of wheels for greater ease and uniformity of work. The huge prairie-farms of America have given a great impetus to the improvement of ploughs, and it is in that country that the greatest variety is to be found. One of the most useful of these varieties is the double gang-plough. In this there are two shares set parallel to each other, but one in rear of the other, so as to make two furrows, and each of these shares has a removable point, which can be changed when it wears down. To the front part of the beam is fixed a single wheel, which can be adjusted by an arc-shaped lever, so as to regulate the depth of the furrow. The application of steam-power to ploughing has made comparatively little progress, though it has been employed with advantage in cultivating the wild lands in the north of Scotland, on the huge farms of America, and elsewhere where ploughing on a large scale is needed. The most ordinary form of steam-plough is one which is worked by a stationary engine at one end of the line and a drum secured at the other end, the two working an anchored cable and the plough, which turns several furrows, passing to and fro from one to the other, the points of appui being shifted as the work proceeds. The plough itself forms an obtuse angle, the exterior sides of which are provided with shares, and the one side is in the air while the other is at work. Each side of it is fitted with a seat and a steering-rod for the man who accompanies the plough.

Plover, a general name for birds of the family Charadriidæ, very widely distributed. They frequent the shores or marshy grounds near water, and feed on molluscs, worms, and insects; but many of them retire inland to breed. The bill is

stout, moderately long, with the nostrils at the base. The legs are long and slender, the toes united by a small membrane, the hinder toe small and elevated or absent, the wings are pointed, and the secondaries long. Very many of them are valued for the table, and their eggs are considered delicacies. The Golden or Yellow Plover (*Charadrius pluvialis*) visits Britain in its summer migration, and breeds in the northern parts, especially in the Highlands and Western Islands of Scotland. The average length is about 10 inches. The plumage of the upper surface in the adult male is black spotted with yellow and white. In the breeding season the under parts are black, becoming whitish in winter. The nest is a mere hollow in the ground, lined with dry grass; the eggs are four in number, pear-shaped, greenish-yellow in colour, with dark blotches and markings. These birds show great care for their young, and often feign lameness to draw intruders away from their nests. This habit is well-known in the Lapwing (q.v.), which is sometimes known as the Green Plover. The Kentish Plover (*Egialitis cantiana*), first taken in 1787 at Sandwich, breeds freely in Romney Marsh, and Yarrell says that dogs are trained to find the eggs.

Plum (*Prunus domestica*), a small fruit-tree belonging to the sub-order Drupaceæ of the Rosaceæ (q.v.), native to Asia Minor and the Caucasus, and naturalised in most temperate parts of Europe. In cultivation its branches are generally spineless; its leaves scattered, stipulate, convolute, simple, ovate, and deciduous; its flowers white; its fruit variable in form, size, and colour, but uniformly glaucous, and with a compressed, pointed stone with a furrow along the edge. It was cultivated by the Neolithic dwellers in Swiss lake-dwellings: the Damson or Damascus variety was grown by the Romans from very early times: the Orleans plum is said to have been brought to England in the time of Henry V.; and the Greengage, named from one of the Gage family who introduced it here, in France is known as Reine Claude, from the wife of Francis I. Besides large quantities of many varieties, both home and foreign grown, which are eaten raw, in tarts, and in preserves, we import considerable quantities of dried plums, known as *prunes*, or, when small, as *prunelloes*. Among these are the Elvas from Portugal, the Carlsbad, the St. Julien (used especially medicinally as a mild laxative), and the St. Catherine from Tours. Bordeaux is the centre of the prune-packing and exporting trade; but large quantities are sun-dried in Bosnia. The spirit known as *raki* is distilled from the fermented juice.

Plumbago. [CARBON.]

Plumbic, salts of lead (q.v.) which may be regarded as derived from the oxide PbO, by replacement of the oxygen by equivalent elements or groups—*c.g.* Pb(NO₃)₂, PbCl₂, PbSO₄, *plumbic*, *nitrate chloride*, and *sulphate* respectively.

Plume-Birds. [LONG-BILLED BIRDS OF PARADISE.]

Plume Moths, a section of Microlepidoptera in which each of the fore wings is usually cleft into two feathers and the hind wings into three; they belong to the family *Pterophoridae*. The English species, which is largest, and therefore best known, is the "White Plume Moth" (*Pterophorus pentadactylus*, Linn.); it is common in gardens. The insect known as the "Twenty Plume Moth" has each wing split into six feathers; but it does not belong to the *Pterophoridae*, but to a distinct section of the Microlepidoptera.

Plumptre, EDWARD HAYES (1821–91), distinguished English divine and scholar, graduated at Oxford and was elected a fellow in 1844. He entered the Church, and was appointed professor of pastoral theology in 1853, professor of New Testament exegesis in 1864, and Boyle lecturer in 1866. In 1869 he became one of the revisers of the Bible, and continued in that post till 1874. Besides poems and occasional sermons, he published translations from Sophocles (1866), from Æschylus (1870), and Dante (1886). His Boyle lectures appeared in 1867, and he was made Dean of Wells in 1881.

Plumularidæ, a family of Hydroidea which is characterised by the possession of the structures known as nematophores. There are seventeen English species belonging to five genera. They are all marine and plant-like in form. The best known English genera are *Plumularia*, *Aglaophenia*, and *Antennularia*.

Plumule, the primary bud or rudimentary shoot in the embryo of a flowering plant.

Pluralism, a word used in the Church to signify the holding by one individual of two or more benefices. It was forbidden by canon law, but permitted by dispensation of Pope or bishops. Many Councils and English Acts of Parliament have condemned the practice; and by 1 & 2 Vict. and 13 & 14 Vict., while vested interests were protected, it was enacted that no person should hold two benefices which were more than three miles apart, and in any case the annual value of one of them should not exceed £100, and that no two should be held one of which comprised more than 3,000 souls and the other 500. No person holding more than one benefice may hold a third, or any cathedral preferment. Other regulations were added by 18 & 19 Vict.

Plush, a woven cloth resembling velvet, but having a longer nap. It varies both in texture and material, the latter being cotton, silk, wool, goat's hair, swan's down, etc., and the nap being either in the warp or woof, either of these in such case being doubled. Plush for hats was first manufactured in Prussia, but in the 19th century the manufacture was introduced at Lyons, and France is now the chief seat of the manufacture. The warp is of silk, with cotton woof, and the nap is of dressed silk.

Plutarch, probably the most widely read of all Greek writers, was born in Chæronea in Bœotia, but his early life is very obscure, nor is the date of his death known for certain. In A.D. 66 he was a young man, and he is known to have survived

till 120. During the reign of Domitian he visited Rome and lectured on philosophy, but it is curious that the Roman writers do not mention him. After his sojourn in Rome he is supposed to have retired to his native place, and to have written some of his famous *Lives* there; certainly his *Life of Demosthenes* was composed in Chæronea. He became a priest of Apollo, married and had several children, and received several public appointments from Trajan. His writings consist chiefly of moral essays, apart from the biographies. The former are little read, the latter are universally known and admired. There are forty-six of them, entitled *Parallel Lives of Greek and Roman Writers*. He arranges them in couples, with a view to contrasting their qualities. He is not considered a first-class writer, his style lacking ease and finish; but it is needless to insist upon the great value of his writings to posterity. They have stood the test of many centuries of criticism, and not merely interest the scholar, but are a recreation for all desirous of knowing something of the lives of the great classics. His wonderfully vivid and genial portraits appeal to all classes of people. In his great work appear all the notable writers concerning whom he could glean any particulars. To his labours we owe in many cases most of our knowledge of certain of the ancients, and it is very peculiar, too, that from his pages we learn more about himself, perhaps, than from any other source. He is not unnaturally more partial to his own countrymen than to the Romans; but he seemed to be somewhat free from the narrowness which characterised other writers. He disliked the Epicureans, and was not at all favourable to the paradoxes of the Stoics. Socrates and Plato he deeply revered, and always celebrated their birthdays with due ceremony. That he made many blunders is true, and scholars have at different times severely condemned them, but there is something so pleasant, amiable, and courteous about his manner, and then the reading of his *Lives* inspired some of Shakespeare's greatest plays, as indeed much of the noblest literature of modern times, so that his occasional faults should be overlooked. He did not pretend to the microscopical treatment modern scholars have applied to the subjects he dealt with; he simply told what he knew of the men he described in the simplest and most direct manner. His love of wisdom and virtue are evident in his desire to bring out those qualities most prominently in his heroes. His work has been translated numberless times, and Clough's is considered the best English version.

Pluteus, the embryo of the Sea-urchins and Brittle-stars. It owes its name to the easel-like arrangement of the calcareous rods which form the skeleton. These and the arms are absorbed during development, and represent larval characters that have been acquired, and are not vestiges of any former condition of the adult.

Pluto, the god of the dead in Greek mythology, was the son of Cronus and Rhea and brother of Zeus and Poseidon (Neptune). The three brothers having deposed their father, cast lots for heaven, the sea, and the infernal region, Pluto obtaining

the latter and becoming lord of "the house of Hades," the domain of darkness. Pluto's other and more ancient name was Hades. Ulysses in the *Odyssey* is represented as sailing towards a far western land, where he encounters Cimmerian gloom; and according to one Greek legend that was Hades. Another tradition places Hades on the verge of the ocean; but the common tradition locates Pluto's kingdom below, and the ground was tapped in invoking him. Hades was not a place of punishment, but simply the abode of death, and Pluto its ruler, his wife being Proserpine.

Plymouth, a seaport, municipal and parliamentary borough (returning two members), situated on the Sound of the same name in the extreme S.W. of Devonshire, England. With Devonport and Stonehouse it forms "The Three Towns." The Sound, protected by the famous breakwater, affords anchorage for the whole navy of England. Mill Bay, where the Great Western Docks are placed, and Sutton Pool accommodate many mercantile ships, and are divided by the lofty promontory known as the Hoe, where stands Smeaton's reconstructed lighthouse and Boehm's statue of Drake. The Government Dockyard in Devonport with Keyham factory and the arsenal make up one of the most complete naval establishments in the world. The church of St. Andrew, dating from 1430 and restored in 1874, is the only remnant of antiquity. There are but few local manufactures except sail-cloth, ropes, biscuits, soap, and gin; but a large foreign and coasting trade is carried on, the exports being chiefly minerals, ores, and marble. Plymouth is an important centre of traffic for goods and passengers. The names of the early explorers Cockeram, Gilbert, Hawkins, and Drake will for ever be associated with the place.

Plymouth Brethren, a religious sect founded in England in 1830 by John Darby, a barrister, who originally belonged to the Church of England. He lectured in many countries, his contention being that the Church had lost touch with society, and so he wished to form a voluntary association, the members of which should possess equal rights of addressing and exhorting one another, their services in this respect resembling those of the Society of Friends. Divisions arose, but Darby founded congregations in Plymouth, London, Exeter, and elsewhere, and gained some success in the Swiss Canton de Vaud. The views of the sect, which professes no special creed, are a mixture of Calvinism and Mysticism.

Pneumatics is that branch of physical science which treats of gaseous fluids. [GAS.]

Pneumo-gastric Nerve. The pneumo-gastric or vagus nerve has a more wide distribution than that of any other cranial nerve. It supplies branches to the pharynx, it gives off a *superior laryngeal* branch which is chiefly sensory in function, and the inferior or *recurrent laryngeal* nerve, which is the motor nerve of the larynx. It supplies the œsophagus, it gives off branches which

enter largely into the supply of nerves to the heart and lungs, and its terminal branches ramify over the walls of the stomach. The vagus also communicates freely with neighbouring cranial nerves.

Pneumonia, inflammation of the lungs. This disease may be due to exposure to cold, or to extension of inflammation from the pleura without or from the bronchial tubes within. It is sometimes traceable to the inhalation of irritant particles, and occurs in connection with various fevers, and with heart or kidney disease. In some instances it appears that pneumonia is due to invading micro-organisms.

Two chief varieties of pneumonia are described, viz. *croupous* or *lobar* pneumonia, in which it may be an entire lobe of the lung is involved, and *catarrhal* or *lobular* pneumonia, in which the disease is usually secondary to mischief affecting the smaller bronchi, and is of "patchy" distribution.

In acute lobar pneumonia three stages of the disease are recognised. There is first the stage of *hyperæmia* or *engorgement*, in which the affected portion of the lung is congested. Then follows the stage of *red hepatisation*, in which the lung becomes consolidated by the effusion of inflammatory material into the pulmonary alveoli. In the third stage the effused material becomes more fluid and purulent in character (*grey hepatisation*).

Lobular pneumonia is usually met with in children, and is often associated with collapse of portions of the lungs.

The chief symptoms of the disease are fever, difficulty of breathing, and cough often accompanied by a peculiar, slightly blood-stained, tenacious, "rusty" sputum. Pain, if present, is usually due to associated pleuritic mischief. On physical examination of the chest during the first stage of pneumonia, the phenomenon known as *fine crepitation* is observed; when the lung becomes consolidated, dulness on percussion is elicited, and bronchial breathing is heard over the affected area. Pneumonia often terminates by *crisis*, the temperature suddenly falling after the lapse of five, six, or more days. In rare instances abscess or gangrene of the lung occurs as a sequel to pneumonia. Treatment is that of fever with the administration of such remedies as may be deemed necessary to relieve the symptoms due to the lung mischief. Counter-irritation is sometimes employed, bleeding was at one time largely used, and the application of leeches to the affected side of the chest is still often prescribed. The use of stimulants is called for in severe cases.

Po (anc. PADUS), the largest river of Italy, rises near Monte Viso in the Cottian Alps, and, taking a N.E. course as far as Turin, then turns due E. till it discharges itself by many mouths into the Adriatic, half-way between Venice and Ravenna. Its length is about 420 miles, and the area of its basin may be put at about 27,000 square miles. It is navigable for vessels of 15-feet draught as far as the junction of the Adda, and for smaller craft to Pancalieri. In its lower reaches it has to be guarded by huge embankments, and it is liable

to disastrous floods and rarer droughts. The Dora Riparia, Dora Baltea, Sesia, Ticino, Adda, Oglio, and Mincio from the N., and the Tanaro, Bornida, Trebbia, Taro, Parma, Enza, Secchia, and Panaro from the S. are its principal tributaries.

Poaching, the popular term for the offence of unlawfully taking or destroying game, which is one against public order. By an Act of Parliament of the present reign entitled "An Act for the Prevention of Poaching," power is given to any constable in any highway, etc., to search any person whom he may have good cause to suspect of coming from any land where he shall have been unlawfully in search of game, and having in his possession any game unlawfully obtained, or any gun, or net for taking game; and also to stop and search any cart, etc., in which such constable, etc., shall have good cause to suspect that any such game, etc., is being carried by any such person; and should there be found any game, etc., upon such person, cart, etc., to seize such game, etc., and such constable, etc., shall in such case apply to some justice for a summons, citing such person to appear before two justices, by whom the party may, on conviction, be fined any sum not exceeding £5, etc. An appeal against a summary conviction is given to the Quarter Sessions. The word "game" in this Act includes hares, pheasants, and partridges, woodcocks, snipes, rabbits, grouse, black or moor game, and eggs of grouse, black or moor game.

Besides the above enactments, there is still more stringent punishment awarded by earlier statutes for poaching *by night*; it is provided that if any person shall *by night* unlawfully take or destroy any game or rabbits in any land or on any public road, etc., or shall by night be in such places with any gun, net, engine, etc., for the purpose of taking game, he shall be liable to imprisonment for the first offence for any period not exceeding three months with hard labour, and at the expiration of such period to be bound over to his good behaviour by sureties for a year, or in default thereof to be further imprisoned for six months or until such sureties are found. For a second offence he is liable to imprisonment for six months, and then to be bound in sureties for two years, and in default thereof to be further imprisoned for one year or until such sureties are found; and if he offend a third time, he is guilty of a misdemeanour, and liable to penal servitude or imprisonment with hard labour for not more than two years. When any person is found committing such offence, the owner or occupier of the land, or any person having a right of sporting thereon, or the lord of the manor, or the gamekeeper may apprehend him; and if he assault the person apprehending him, he is guilty of a misdemeanour, and liable to penal servitude or imprisonment with hard labour for not more than two years; and where any persons *to the number of three or more by night* unlawfully enter lands for the purpose of taking or destroying any game or rabbits (any of them being armed with any gun or other offensive weapon) they are to be deemed guilty of a misdemeanour, and are liable to penal servitude for

any term between seven and five years, or imprisonment with hard labour for not more than three years.

Pocahontas was born about 1595, and was the daughter of Powhatan, the King of the Virginian Indians. When Captain John Smith, the coloniser of that State, was about to be dispatched by the savages she saved his life, and later was able to warn him of an intended massacre of the English. She fell in love with John Rolfe, one of the English colonists, and was married to him, after which she came to England and was presented at Court. In 1617 she died at Gravesend at the early age of 22, just as she was embarking for Virginia, leaving a son, from whom the Virginian Rolfes are descended.

Pochard, any duck of the marine genus *Fuligula*, in which there is a lobe on the hind toe. The Common Pochard (*F. ferina*), which visits Britain in winter, has the head chestnut-red, the throat black, and the body plumage grey. It sometimes breeds on inland lakes.

Pocock, EDWARD, D.D. (1604-91), Orientalist, was born at Oxford and died there. After graduating at its university, he took holy orders, and in 1648 became professor of Hebrew. As an Arabic scholar he had no equal in England, and his *Specimen Historiæ Arabum* (1649) is a monument of learning. He published other erudite works, his Biblical writings appearing in two folio volumes in 1740.

Pococke, RICHARD, LL.D. (1704-1765), a great traveller, was born at Southampton. He was a clergyman, and eventually became Bishop of Meath in the year of his death. After long journeys in the East he published a *Description of the East and of other Countries* (three folio volumes, London, 1743). He left a larger number of manuscripts, which are in the British Museum, and from these have recently been printed his very quaint and valuable *Tours in Scotland* (1887) and *Tour in Ireland in 1752* (1891).

Podargus, a genus of Goatsuckers with ten species, from Australia, Tasmania, and the Papuan Islands. They are nocturnal insect-eating birds, sometimes called "frog-mouths" from the width and breadth of their gape. There is no oil-gland, but the rump bears a powder-down patch on each side. *P. strigoides* is called by the colonists "More-pork" from its cry.

Podiebrad, GEORGE (1420-71), greatest King of Bohemia, was the son of a Bohemian noble, and entered the army at an early age, when his gallantry speedily procured his promotion. In 1444 he became leader of one of the most powerful parties in Bohemia. Being a Hussite, he was twice excommunicated by Pope Paul II. for contumacy. He became regent for the youthful King Ladislav, and on the latter's death was elected king, in spite of the Papal wrath. He forced his enemies to come to terms with him, and gained many brilliant victories over the leagues organised against him.

Podophthalmata, or STALK-EYED CRUSTACEA, are those in which the eye is situated at the end of a flexible peduncle or stalk; this is the case in the Stomatopoda (q.v.) or Locust-shrimps, the Schizopoda (q.v.), as *Mysis* the Opossum-shrimp, and the Decapoda (q.v.), including all the Lobsters and Crabs. These were therefore all once grouped together as the Podophthalmata, while the sessile-eyed members of the Malacostraca (q.v.) or higher Crustacea, were united into the sub-class Edriophthalmata. As it is now believed that one order, the Cumacea, the members of which have sessile eyes, is more nearly allied to the stalk-eyed group, this classification has necessarily been abandoned. The Malacostraca are now therefore divided into three groups, the Leptostraca (q.v.) for Nebalia, the Arthrostraca, including the Amphipoda (q.v.) and Isopoda (q.v.), and the Thoracostraca, including all the Stalk-eyed Crustacea and the Cumacea.

Poe, EDGAR ALLAN (1809-49), American poet and novelist, born at Boston, Massachusetts, was the son of players connected with the Boston stage, who left him an orphan at an early age. He was then adopted by Mr. John Allan, a rich tobacco merchant of Virginia, whose wife, having no children, had taken a liking to him. He was a boy of great intelligence, and made great strides in learning when put to school, but was of a somewhat retiring disposition. In 1815 he was brought to England by his foster-parents (whose name he had added to his own) and was sent to a school in Stoke Newington, remaining there five years. On his return to Virginia he entered its university and matriculated there, but contracted some bad habits there and ran into debt through gaming. His foster-father took him into his business as a clerk, but Poe soon gave it up and went to Boston, where, in 1827, he published his first volume of poems, which was received with indifference. Having no money, he then entered the army, and for a time his conduct was so exemplary that Mr. Allan bought him a cadetship, which, however, he did not appreciate, and acted in such a manner as to get cashiered in 1831. Not long before this he had brought out a second edition of his poems, and in 1831 another volume of them was issued in New York, and was also badly received. Going to Baltimore, he obtained some journalistic work through the influence of John Pitt Kennedy, an American writer, and there edited a paper, for which he wrote some of his most marvellous stories. In 1836 he married his cousin, and his prospects were very bright; but his waywardness was shown in 1837, when he resigned and went first to New York and then to Philadelphia, in which cities he became editor of several papers in succession. He published a collection of his stories in the latter place in 1839, but obtained absolutely nothing for them. His powerful tale of *The Murders in the Rue Morgue* appeared in 1841, and may be considered the foundation of the modern detective story. His popularity in France was due to this work. Two French journals used the story without acknowledgment, and a libel action arose between them, in the course of

which Poe's name was frequently mentioned, with the result that he gained a reputation in that country such as few English authors have achieved. Poe's propensity to liquor had been increasing slowly, when his wife fell ill. They were in poverty at this time, and Poe went to New York again in 1844. In 1845 appeared *The Raven and other Poems*, and the disappointment caused by the utter indifference to his writings led Poe to indulge still further in stimulants. He wrote very severely against many of his contemporaries, and was a savage critic. About 1846 a public appeal was made for himself and family, and in 1847 his wife died. Poe had now no restraint, and seems to have gone from bad to worse. Though his faults have been even more exaggerated than his virtues, it is quite certain that he was found unconscious in a liquor saloon at Baltimore on October 3rd, 1849, and died of delirium tremens. He was then about to be married to a widow of Richmond, Virginia. Poe is probably the greatest literary genius America has yet produced, and is now as honoured as he was in life neglected. In 1875 a monument was raised to his memory in Baltimore. The best English edition of his works is that by Mr. John H. Ingram.

Poerio, CARLO (1803-67), Italian patriot, who in early life sought to drive the Bourbons from Italy, for which he was arrested and imprisoned several times between 1837 and 1848, in which year, after certain concessions of King Ferdinand, he became prefect of police at Naples and Minister of Public Instruction. During the revolution of 1848 he was arrested as a conspirator and sentenced to twenty-four years' imprisonment in chains, but escaped from the ship which was taking him to the convict settlement and came to England, where he was well received. Mr. Gladstone's famous *Letter to Lord Aberdeen* called attention to the cruel treatment he received as a prisoner. After some years Poerio got back to Italy, and became a member of the first Italian Parliament.

Poetry is a subject hardly less difficult of definition than Religion, into which, indeed, in its higher reaches, it runs up. There has, in particular, been great difference among philosophers and critics as to whether metre is one of its essential elements. To Aristotle and Plato rhythm was of subordinate importance, and among modern philosophers Coleridge explicitly declares that there may be poetry (as distinct from a poem) without metre. The set of more recent authority, however, appears to be in the other direction. Etymology undoubtedly favours the more comprehensive definition, for among the Greeks *poiētēs* signified "a maker," "a creator," not necessarily of song, nor even of any other work of art. A consideration of much greater weight is that the opposite view implies the equal importance of *form* with *contents*, since it is admitted that there is much prose which lacks no quality of the highest poetry save that from its structure regular rhythm is absent. Nor even in form is the difference between verse and prose-poetry absolute; for the latter almost invariably falls into a rhythm of its own—less regular than that of verse, but none

the less yielding abundant pleasure to the ear by its mere movement. To say that there can be no poetry without metre is to assert that there is no poetry in Hebrew literature, which, though it has no nearer approach to rhythm than parallelism, nor to rhyme than assonance, has yet produced the Book of Job, the Prophecies of Isaiah, the Psalms, the Canticles, and the Song of Deborah. On the whole, therefore, it seems preferable to define poetry as *the art in which imagination, fancy, and emotion have for their medium elevated language, sometimes rhymed, and generally metrical*.

By Coleridge the origin of metre is traced to a spontaneous effort in the creating mind to hold in check the workings of passion, and so to ensure it against the evil of unrestrained expression. This, however, is to assume that the creating mind achieves no more than it intends. It is excessively difficult to see how an aim so remote, and calling for so resolute an exercise of the will, could fail to be present to the poet's consciousness, whereas it is matter of universal experience, as indeed Coleridge concedes, that the expression of imagination and passion in language more or less rhythmical is purely instinctive. It might with as much, or as little, plausibility be suggested that when the poet adds to his metre rhyme, he does so in order further to increase his difficulties, and not because of the enhanced pleasure which he derives from the musical terminations of his verses, and wishes to communicate to his reader.

Poetry is divided into three main categories—*lyric* or subjective, including the song, the hymn, the elegy, the ode, the sonnet; *epic* or narrative, to which the ballad belongs; and *dramatic*. In a single word, these categories may be expressed as Song, Tale, Play. It is not easy, however, to find a place under either head for didactic and satirical poetry. A large part of the production in both these kinds occupies neutral territory between poetry and prose, being prose as to its contents and poetry as to its form. It may be worth consideration whether, having regard to the tendency of the times to analytic and philosophic poetry, the time has not come to erect a fourth category—the *reflective*—which would relieve the epic and the lyric of much that does not naturally fall within the province of either. The monologue, a form which Mr. Browning did so much to develop on the dramatic side, is often at once lyric, epic, and dramatic.

Pogge (*Agonus cataphractus*), a small acanthopterygian fish, having the head and body angular, and covered with bony plates. It is often taken on the British coast. [BULLHEAD.]

Poggio, GIOVANNI FRANCESCO, otherwise BRACCIOLINI (1380-1459), an Italian scholar, was born near Florence, and when twenty-two years old entered the Papal service as secretary of Boniface IX. His enthusiasm for the classics and his great learning led to his instituting searches for copies of ancient works in the monasteries of Italy and other countries, particularly at St. Gallen, and he made some remarkable discoveries, including Quintilian's *Institutions*, the greater portion of Lucretius'

De Rerum Natura, eight orations of Cicero, twelve comedies of Plautus, etc. His bad temper and quarrelsome disposition, however, embroiled him with many scholars and injured his contemporary renown. In 1417 he came to England, where he resided awhile. He died at Florence, of whose republic he was chancellor, and among his best-known works, which are all in Latin, are his *History of Florence* and his very gross *Facetiæ*.

Poinsettia, a name still commonly applied by florists to a South American species of Euphorbia, largely grown in our hothouses. It is remarkable for its large, pointed, veined, and leaf-like bracts, either deep-red, or less commonly ivory-white, which surround the inconspicuous flower-heads. In sub-tropical regions it is shrubby; but with us is only a pot-plant. It is largely used in church-decorations. There are no botanical characters to separate it as a genus from Euphorbia. [SPURGE.]

Point is a mathematical conception used to define position. It has no dimensions; two points placed so as to touch each other will occupy no more space than one point—in fact, no finite number of them will form anything larger. A circle of infinite curvature becomes a point.

Pointer, a breed of sporting dogs of Spanish origin, introduced into England in the 18th century, and since then modified with a strain of foxhound blood to such an extent that, according to Borrow, the present English breed differs totally from any native Spanish dog. Pointers are of medium size, close-haired, generally liver-coloured or liver and white; some, however, are black, and others again show the tan markings of the hound. The peculiar habits of this dog are indicated in the name. As soon as it scents game, it stands still, with the muzzle raised and "pointing" in that direction; one fore-leg is usually also lifted, and the tail sticks out straight behind. The habit is inherited by young dogs. Since driving and walking up birds has become common, the use of pointers has been on the decrease.

Poison. A poison is a substance which, when introduced into the body, is capable, by virtue of its own inherent chemical properties, of causing impairment of health or of destroying life. Poisons have been classed as *irritants* and *neurotics*, the latter group being sometimes subdivided into narcotics and narcotico-acrids. The principal irritant poisons are the mineral acids, oxalic acid, the alkalies, phosphorus, arsenic, antimony; certain salts of copper, mercury, and lead; savin, croton oil, colchicum, and cantharides. The chief symptoms produced by poisons of this kind are those of irritation of the alimentary tract, pain, nausea or actual vomiting, and purging are common, cramp in the limbs, and faintness or even extreme collapse may be present. Some of these poisons actually corrode the tissues subjected to their influence; this notably happens in the case of the mineral poisons. The chief neurotic poisons are opium, belladonna, alcohol, ether, chloroform, chloral, prussic acid, and strychnia. These poisons act mainly upon the nervous system. Certain gases when inhaled exercise poisonous properties. The

chief of these are carbonic acid, which collects in mines, and in connection with the burning of lime; carbonic oxide, which is a constituent of coal-gas, is developed in charcoal-burning; and sulphuretted hydrogen. The treatment of poisoning consists, first, in removing as much of the poison as possible from the system, and, secondly, in attempting to neutralise the action of so much of the poison as cannot be removed by the administration of the appropriate antidote. The use of the stomach pump is generally resorted to with a view to removing the poison from the stomach. In the case of some corrosive poisons this plan, however, cannot be adopted. If the contents of the stomach cannot be immediately evacuated by other means an emetic is sometimes employed, sulphate of zinc in a dose of twenty grains for an adult being one of the most reliable forms of emetic to use. In the case of a child a teaspoonful of ipecacuanha wine may produce the desired effect. It is only in the case of a few poisons that satisfactory antidotes exist. In poisoning by mineral acids, chalk or carbonate of magnesia is employed; in poisoning by alkalies, lemon juice or vinegar may be administered. The antidote for arsenic is the freshly precipitated ferric hydrate; for oxalic acid, saccharated solution of lime; for perchloride of mercury, white of egg; for lead salts, sulphate of magnesia; and for tartar emetic, tannic acid in solution in the form of strong tea may be given. The subject of treatment is more fully dealt with under the heads of the special substances which produce poisoning.

Poisson, SIMEON DENIS (1781–1840), French mathematician, was successively assistant professor, professor, and examiner at the Polytechnique, his connection with it lasting forty years. He produced some profound mathematical works, and was the discoverer of some important truths, gaining thereby an European reputation. In 1837 he was made a peer of France. His *Treatise on Mechanics* is of the highest value to advanced students, and his *Mathematical Theory of Heat* is a masterly examination of the causes of the conduction of heat.

Poitiers, formerly the capital of Poitou, and now the chief town of the department of Vienne, France, stands on the sides and summit of a plateau above the junction of the rivers Boivre and Clain, 206 miles S.W. of Paris on the Bordeaux Railway. It passed as part of the dowry of Eleanor of Guienne to the English Crown in 1133, but was recovered by Philip (Augustus). The battle of Poitiers (1356) restored it to Edward III. for a few years, when Duguesclin finally added it to French territory. The cathedral of St. Pierre, founded by Eleanor, contains the bones of Richard Cœur de Lion, and the church of St. Jean is the oldest Christian structure in France, but now serves as a museum.

Poitou, an old province of France, derives its name from the Pictones or Pictavi, the tribe found in occupation of the district by the Romans. Bounded N. by Touraine, Anjou, and Brittany, E. by Touraine, Berri, and Marche, S. by Angoumois, and Aunis, and W. by the sea, it was divided into Upper and Lower Poitou. The former is now



1. Water Hemlock (*Cicuta sp.*) 2. Hemlock (*Conium maculatum*) 3. Foxglove (*Digitalis purpurea*) 4. Cypress Spurge (*Euphorbia cyparissias*) 5. Pasque Flower (*Anemone pulsatilla*) 6. Autumn Crocus (*Colchicum autumnale*)



Deadly Nightshade (*Atropa Belladonna*). 1 2 Thorn Apple (*Datura Stramonium*) 3. Henbane (*Hyoscyamus niger*). 4. Mezezon (*Daphne Mezereum*) 5. Fool's Parsley (*Aethusa Cynapium*). 6. Herb Paris (*Paris quadrifolia*)

comprised in the departments of Deux-Sèvres and Vienne, the latter in La Vendée.

Poker, a round game of cards, played with a full pack of thirty-two, and forming a variety of the game of Brag. The dealer distributes five cards to each player, and the eldest hand deposits a stake called *ante*. Each player may discard and take fresh cards, and the second player may pass, and throw up, or, if the eldest hand has declared *ante* good, *chip to fill*, i.e. stake a sum equal to *ante*, or, if *ante* is not good, a stake double the *ante*. Then each player in order may *see the raise*, or *go better*. If one remains in alone, he takes the pool; if there are several equal, the hand is *called*, and the player on left of the caller shows his cards. The hands are then shown out, the scoring points being a straight flush, fours, full, flush, straight, triplets, two pairs, one pair, highest card. There are several varieties of the game.

Pola, the chief naval station and arsenal of Austria, is situated in Istria on a headland 55 miles south of Trieste. Austria acquired it with Venetia in 1815, and its modern rise began in 1848. The port, divided into two basins by an island, is almost land-locked, and has strong fortifications. Everything needed for a large fleet can be made in the arsenal, whilst there is ample accommodation for the growing commercial traffic. Among other Roman remains are an amphitheatre and temple of Diana.

Poland is the name still generally applied to so much of the Polish territory absorbed by Russia as was formed into an autonomous kingdom in 1815, although after 1863 this part of the Russian Empire was officially designated "the territory of the Vistula," and, later, "the Vistula governments." The native name is *Polska*, from the same root as *Pole*, "a plain;" and the territory, which measures 49,157 square miles, consists for the most part of an undulating plain from 300 to 450 feet above the sea, joining the lowlands of Brandenburg on the west to the great plain of Central Russia on the east, but gradually rising in the south to a range of plateaus which vary in height from 800 to 1,000 feet and blend with the spurs of the Carpathians. It is bounded on the N. by the provinces of western and eastern Prussia, on the W. by Posen and Prussian Silesia, on the S. by Galicia, and on the E. by the Russian governments of Volhynia, Vilna, Grodno, and Kovno, and is divided into ten provinces—those of Kalisz, Kielce, Lomza, Lublin, Piotrkow, Plock, Radom, Siedlce, Ssuwal-ki, and Warsaw. It is rich in minerals, but agriculture is the main industry. In the eastern districts there are large tracts of sand, swamp, and heath; but for the most part the soil is a rich loam, yielding abundant crops of rye, wheat, barley, hemp, but bearing also extensive forests of pine, oak, birch, etc., while large portions are devoted to pasture. The railways are less than a thousand miles in extent. There is no trial by jury, and the entire administration is subject to a Governor-General.

The so-called "kingdom of Poland" of to-day is all that now, even in common speech, bears the name of a nation that once dominated Europe and saved

Christendom from the Turk. Its *history* may be said to begin in the 9th century with the founding of the Piast dynasty. The first Christian monarch was Mieczyslaw I. (962-92). His son, Boleslaw I., "the Great," pushed back the frontiers of the kingdom beyond the Oder, the Carpathians, and the Dniester, and wrested Cracovia, Moravia, Lusatia, and Misnia from Henry II. of Germany. The line ended with Casimir III. in 1370. It was followed after an interval of eighteen years by that of the Jagellons, the first of the dynasty being Wladyslaw IV., by whom Lithuania and Poland were united, and who was also chosen King of Hungary. When this line in



MAP OF POLAND.

turn became extinct, with the death of Sigismund II. in 1572, after a period of great military achievement and internal development, the monarchy, at the instance of the military classes, became formally elective, the election to be by the unanimous vote of the two chambers of the Diet—that of the chief nobles and that of nuncios representing the lesser nobles. The bitter intolerance, religious and political, which had much to do with the decadence and downfall of Poland, first became prominent in the reigns of the three Swedish kings Sigismund III., Wladyslaw VI., and John Casimir, whose rule extended from 1586 to 1648. The Cossacks of the Ukraine, who had been subdued in the preceding reign, were oppressed until they revolted and sought the aid of Russia. In 1673 the Turks, after a career of victory, were overwhelmed at Choczim by John Sobieski the Hetman, who was then chosen king, and reigned from 1674 to 1696.

The early years of the 18th century were years of persecution and anarchy. Later in this century (in 1766) Russia, Denmark, Prussia, and England, interfered on behalf of the persecuted Dissidents from the dominant Roman Catholic faith. The civil war which followed was taken advantage of by Austria to resume the county of Zips, which had been pledged by Hungary to Poland early in the 15th century. Russia and Prussia needed no other excuse for effecting the partition which they had long meditated. In this first

partition, in 1772, when Poland had an area of 283,000 square miles, with a population of some thirteen millions, Russia appropriated 42,000 square miles, Prussia 13,000, and Austria 27,000. The second division, in which Catherine II. was the moving spirit, followed in 1793 in spite of heroic resistance headed by Joseph Poniatowski and Kosciusko; Russia this time not being content with less than 96,000 square miles, while Prussia was only adequately rewarded by 22,000. Only two years later the work of dismemberment was completed after a series of desperate battles, in which the Russian and Prussian armies were defeated, and Poland was only finally overpowered by the intervention of Austria. What was left of Poland was now divided between the three powers—Russia again taking the lion's share—and Poland ceased to be. In all, Russia had absorbed 180,000 square miles, Prussia 57,000, and Austria 45,000. By the Treaty of Vienna the division was somewhat modified in favour of Russia, and it was then that the "kingdom of Poland" was constituted. At first it possessed full autonomy, the only link between it and Russia being that its sovereign was the Czar. But in 1832 it was deprived of its constitution, and in 1864 it was absolutely incorporated with Russia; and the steady policy of the Russian Government ever since has been to crush out the sentiment of nationality in every one of its forms. Austria and Prussia have had comparatively little trouble with their portions of the spoil; but Russia has had to encounter several formidable rebellions, which have been suppressed with cruel severity. The lot of the peasants has been considerably ameliorated, mainly at the expense of the nobles, whose treatment of their former serfs gave them little title to sympathy; but there is no evidence that even the peasant proprietors have been won over to their conquerors.

Ethnology. Before its dismemberment Poland comprised four ethnical groups: *Lithuanians* in the north, *White Russians* in the east, *Little Russians* (*Ruthenians*) in the south, and *Poles* in the centre and west. These have been identified by Schafarik with Ptolemy's *Bulanes* (2nd century); but they more probably represent the great Slav nation of the *Lekhs* (*Liakhs*), who were seated on the Vistula in the 6th century, and one of whose chief branches were the *Polianes* or "people of the plains," from *polé* (Polish *polak*), "a plain." Since their conversion by Roman missionaries in the reign of Meczislav (962–92), the Poles have always been Roman Catholics of the Latin rite, and their culture has consequently been developed under Western influences. The language, a rich and flexible member of the West Slav division, is written in the Roman character, has borrowed many Latin words, and has even been partly moulded on the model of Latin, which was the language of culture and a common medium of intercourse down to the close of the 18th century. Since then the national speech has been assiduously cultivated by numerous writers, especially historians and poets, some of a high order of merit; and, according to Czinski, it is at present spoken by about 12,500,000, of whom $5\frac{1}{2}$ are in Russian, $2\frac{9}{10}$ in

Austrian, $2\frac{6}{10}$ in Prussian Poland, and $1\frac{1}{2}$ in South and South-west Russia. The purest Polish type is found in the middle Vistula basin and in Posen, where the upper classes are distinguished by regular (and even handsome) features, tall, stout figures, fair complexion, light or chestnut hair, a frank intelligent expression. They are a gay, light-hearted, impulsive, brave, and hospitable people; but with the faults and vices inherent to a social system which for ages recognised only two classes—nobles and serfs.

Polar Bear (*Ursus maritimus*), from the Arctic regions, the largest and most carnivorous of the family, though it eats grass freely in summer. The total length is about nine feet; the head is small, with pointed muzzle, the molars are narrow, and the soles and palms are hairy. The fur is white throughout the year.

Polar Exploration has been carried on both in the Arctic and Antarctic Circles, in the one case as far as 80° N. lat., in the other to a short distance within the Antarctic Circle. The earliest efforts in this direction appear to have been made by the Norsemen; but systematic exploration of a later date had its origin in the attempt to discover a N.E. or N.W. passage to India and eastern Asia with a view to facility of trade. This hope was soon abandoned, and later expeditions have been undertaken out of love of adventure, or to advance scientific ends, or, in some cases, for the sake of discovering the fate of earlier expeditions. In 1497 Cabot found Labrador and Newfoundland, and in 1553 Sir Hugh Willoughby sighted Nova Zemlia. Many other adventurers of different nationalities explored in an eastern direction, but this path soon became abandoned for a time. In the long list of Arctic explorers proper may be mentioned Frobisher (1576), Davis (1585), Hudson (1610), Baffin (1615), Behring (*c.* 1749), a Russian explorer; Scoresby, who added much to our knowledge of these regions (1806); Franklin, who perished in his last expedition (1845); Ross, Parry, McClure, who actually did make the N.W. Passage; McClintock (1857), the Americans Kane, Hayes, and Greeley, and the Norwegian Nansen.

Polarimeter. [POLARISCOPE.]

Polarisation, ELECTROLYTIC. When an electrolyte is decomposed by an electric current, a difference of potential is set up between the anode and cathode which opposes the passage of the current. This represents the force needed to tear apart the molecules of the electrolyte, and is known as the electromotive force of polarisation. If, for instance, water is to be decomposed, at least 1.47 volts are needed; and if, after disconnecting the source of current, the electrodes of the voltmeter are connected to an electrometer, they will be found to differ in potential by that amount. [ELECTROLYSIS.] The term is also used to denote an action which occurs in galvanic batteries: hydrogen tends to be deposited in small bubbles on the surface of the positive pole, reducing its effective area, and so diminishing the action of the cell. [BATTERIES.]

Polarisation of Light. When light is transmitted through, or reflected from, certain substances, it is changed in a peculiar way, and is said to be polarised. Light is caused by ether vibrations, which take place in all directions in a plane at right angles to the direction of the ray, and if light falls upon a surface—say, of glass—it is found that a portion is transmitted through the glass and a portion is reflected. A part of the reflected portion has the peculiarity that its vibrations are all in a plane parallel to the glass, the vibrations in other planes having been transmitted through the glass; and if the beam of light makes an angle of 58° with the normal to the surface, practically all the reflected light will be thus modified. Plane polarisation consists in this quenching or diverting of all the vibrations save those in one particular plane. Some substances, such as tourmaline, will only transmit light whose vibrations are in one plane. Iceland spar, which has the property of double refraction (q.v.), splits up ordinary light into two portions; by cutting a rhomb of spar diagonally and cementing the halves together with Canada balsam these portions may be separated. These two rays, called the ordinary and extraordinary rays, are diffracted in a different ratio by Iceland spar and Canada balsam, from which it results that the ordinary ray is totally reflected [TOTAL REFLECTION] and passes out through one side of the rhomb, the extraordinary ray passing straight through; the latter portion is completely polarised. This arrangement, known as Nicol's prism, is the most perfect device for polarising light. If polarised light falls upon a second polarising body, it may or may not be absorbed; for if we quench the vibrations which are not in one plane (*i.e.* polarise the light) and then further quench those vibrations which are not in a second plane, it is clear that, if these two planes are coincident, the light will not be affected; but if the second plane makes an angle with the first, the light will be more or less extinguished, and will be completely so if the two planes are at right angles. In this case the first Nicol prism or other device is called a polariser, and the second an analyser. Many substances exercise a peculiar influence on polarised light. If a thin film of selenite or mica is introduced between the polariser and analyser, and viewed through the latter, it will in some positions restore the light after it has been extinguished by crossing the prisms; and may, moreover, exhibit brilliant colours, which at first disappear as the analyser is turned; when it has moved 90° from its former position, colours complementary to the former are seen. Many fine effects may be projected on a screen by a lantern by using designs built up of plates of selenite of varying degrees of thickness; the colours change as the analyser is rotated. In these experiments the polarised light is split up into two components vibrating in two planes at 45° to that of the polarised beam; these two are retarded unequally by the film of selenite, so that, when recombined into a single beam by the analyser, the difference in phase of the two sets of vibrations produces interference (q.v.). Analogous effects are produced by non-crystalline bodies

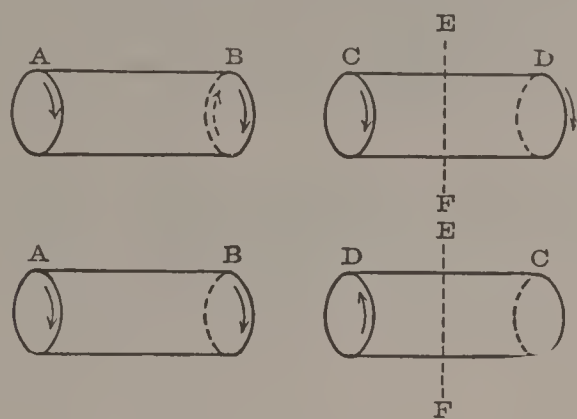
when in a state of strain due to unequal heating, mechanical pressure, or otherwise. Some bodies, such as quartz and sugar solutions, rotate the plane of polarisation—that is, if introduced between two crossed Nicol prisms, the light will be restored, and will not again be extinguished until the analyser has been turned in one direction or the other. If a tube of carbon disulphide or a piece of Faraday's heavy glass is placed between the polariser and analyser, and is subjected to the action of a powerful magnetic field, the plane of polarisation will be rotated, the direction being reversed on reversal of the magnet. A similar effect is produced by subjecting carbon disulphide to electrostatic strain.

Polariscope or Polarimeter is an instrument for measuring the amount of rotation produced by a substance on the plane of polarisation of plane polarised light. In its simplest form it would consist of two Nicol's prisms (q.v.); parallel light sent through the first or "polariser" would be polarised in one plane; it then passes through a second Nicol or "analyser." An observer looking through the analyser will have the field of view variously illuminated according to its position. By rotating this Nicol round an axis perpendicular to its plane a point can be reached when all appears dark—*i.e.* the incident light is completely quenched. If now an "active" substance be put between polariser and analyser, more or less light will get through; by again rotating the analyser the dark position can be rediscovered. The amount of rotation measures the angle through which the active substance has rotated the plane of polarisation. Since it is not easy to be quite certain when the position of absolute darkness is obtained, various devices have been used to avoid the difficulty. The field of view is divided into two parts, and some arrangement is used so that the planes of polarisation of the light are slightly inclined to each other in the two halves. In one case this effect is produced by dividing the analyser into two parts, which are connected together after one of them has been turned end for end. The observer, in using this analyser, rotates it until the two halves are equally dark. Another instrument is provided with what is known as a "biquartz," the two parts of which turn the plane of polarisation in opposite directions; in this arrangement the two parts of the field are brightly coloured, the hues changing as the analysing Nicol's prism is rotated. A position is obtained when the colours of the two halves of the field are the same. Not only crystalline solids have the power of rotating the plane of polarisation of light, but solutions of many substances have the same property, and the amount of rotation produced by a solution in a tube of definite length is often used to determine the amount of active substance present.

Polarised Light. [POLARISATION OF LIGHT.]

Polarity. The two ends of a magnet behave in exactly opposite ways with regard to other magnets and electric currents, and on this account a magnet is said to possess *polarity*; it has two poles endowed with opposite properties. This is

not to be explained by supposing the two ends magnetised with different kinds of magnetism, for such is not the fact; the nature of magnetism is essentially rotary, and all rotating bodies possess a kind of polarity. Suppose two cylinders, A B and C D, to be rotating on their axes in the same direction, the ends B and C are, of course, turning in the same direction as shown in the upper figure; but if, without changing the direction of its rotation we now turn C D about a line E F so as to



POLARITY.

bring it into the position shown in the lower figure, the ends B and D are turning in opposite directions. Now these two cylinders may be considered roughly analogous to two magnets, if we substitute a whirl of electricity for the actual rotation of the cylinders; then A and C would be, say, north poles, and B and D south poles. This two-endedness, or polarity, is characteristic of rotating bodies; a revolving shaft appears to be turning either right-handedly or left-handedly as we view it from one end or the other. A coil of wire carrying a current behaves, of course, just like a magnet, and similarly has polarity.

Polder, the name given in Holland and Flanders to marsh land reclaimed from river or sea. The general method of reclaiming is to erect a dyke to keep out the lower tides and gradually raise and extend it as occasion offers. The lake of Haarlem, in Holland, has been converted into polder, and all along the lower Scheldt may be seen fertile polders covered with cattle and having far inland the remains of ancient dykes, while nearer the river fresh polders are in course of formation. A scheme is afoot to add many thousands of acres to the cultivable land of Lincolnshire by the adoption of similar measures.

Pole. The imaginary ends of the axis about which the earth turns are known in geography as the north and south poles, and this is the most popular use of the word. In the geometry of a sphere the pole of any circle is the point in which a perpendicular to the plane of the circle through its centre cuts the sphere. Every point on the circle is therefore equidistant from it, and, if the circle be a great circle, the distance is 90° . The north and south poles are thus the geometrical poles of the earth's equator. In astronomy they are the points in which the earth's axis, if produced, cuts the celestial sphere; for the sake of distinction, these are often known as the celestial poles. No

stars occur actually at these points (where they would be extremely convenient for astronomical measurements); but the Pole Star (q.v.) is slightly distant from the north celestial pole. Two other points of reference in astronomical measurements are the zenith and nadir, these being the poles of the horizon.

Another use of the word in geometry is to denote the point at which two tangents to a conic meet, this being called the pole of the chord joining the two points of contact. This chord is known as the polar of the point, and the theory of pole and polar is of great use in projective geometry, where their property of reciprocity often gives extremely pretty solutions to certain problems.

Pole, MAGNETIC. Those portions of the earth's surface to which the magnetic needle points are known as the magnetic north and south poles; they are not quite fixed in position, nor do they coincide with the ends of the earth's axis. The poles of a magnet are those portions of its surface at which lines of magnetic force leave the iron or steel; they are therefore the portions at which magnetic effects are apparent. That pole of a magnet which tends to point to the north is commonly known as its north pole, although, as unlike poles attract each other, it is clearly opposite in polarity to the terrestrial north pole. A magnet has usually two poles, but may have more—say, a north pole at each end and a south pole in the middle; the latter is in such a case called a consequent pole. Since a coil of wire acts as a magnet, it also has poles. If on looking at one end of a solenoid the current flows in the same direction as the motion of the hands of a clock, then the end looked at will be the south pole. The unit magnetic pole is defined as one of such strength that it repels an equal pole at a distance of one centimetre with a force of one dyne.

Pole, REGINALD (1500–58), CARDINAL, was of royal descent, and was born at Stourton Castle, in Staffordshire. After a preliminary education at Sheen monastery, he entered Magdalen College, Oxford, and, after graduating, took holy orders. He was immediately invested with various offices by Henry VIII., who clearly destined him for the highest positions in the Church. Pole went to Italy, where he stayed some time, and on his return to England lived mostly in seclusion till 1529, when he was entrusted with the mission to Paris to obtain the sanction of the university there for the proposed divorce of Katharine of Aragon. Pole, however, was strongly opposed to the project, and all relations between him and the king were broken by the publication, in 1536, of his *De Unitate Ecclesiae*, in which he attacked the king and condemned the threatened separation of England from Rome. He was deprived by Henry of all his preferments, but received the cardinal's hat from Rome, and was appointed to rouse the Continental powers against the English reformation. Henry, meanwhile, executed his brother; and later his mother, the Countess of Salisbury, was also led to the block. Pole tried to return to England after Henry's death, but was prevented. He is said to have been offered

and to have declined the Papal throne in succession to Paul III. Not until the marriage of Queen Mary with Philip was he enabled to come to England as Papal legate. He arrived in 1554, and the day after Cranmer was burnt was made Archbishop of Canterbury. He ruthlessly persecuted the Protestants, and exercised his power unsparingly. His support of Philip against France, the Papal ally, led to his quarrel with Paul IV., who deprived him of his office as legate and treated him very harshly. His death on November 18th, 1558—sixteen hours after Queen Mary—is said to have been caused by this severity.

Polecat (*Putorius fœtidus*), a destructive and blood-thirsty nocturnal little animal of the Weasel family, native in Britain and in Central and Northern Europe, of which the Ferret (q.v.) is a domesticated variety. The total length is about 18 inches, of which the tail counts for rather less than one-third. The fur is dark brown above and black beneath, and there are dark-brown and white markings on the face. It feeds on small mammals, poultry, pigeons, such wild birds and their eggs as come in its way, reptiles, amphibians, and fish. Holes in the ground or among faggots afford it protection in the summer, and in winter it finds shelter in outhouses or deserted buildings. Not content with satisfying its hunger and providing for its young, it often kills for the mere sake of killing. To the anal pouch, with its vile-smelling secretion, the animal owes its name of Foumart (the Foul Marten). Polecats pair in early spring, and the young—from three to eight in number, which are often trained for rabbiting—are born in April or May. The Siberian Polecat (*M. eversmanni*), the Tibetan Polecat (*M. larvata*), the American Polecat (*M. nigripes*), and the Mottled Polecat (*M. sarmatica*), from Eastern Europe, the West of Asia, and Afghanistan, are closely allied.

Pole Star, or POLARIS, is the nearest star to the celestial pole (q.v.), being, in fact, only about $1\frac{1}{2}^{\circ}$ away. This distance, however, is not constant, owing to the fact that the earth's axis does not remain absolutely fixed in direction. [PRECESSION.] On account of its small distance from the pole, it will be seen during the night to move in a very small circle about that imaginary point, a star farther from the pole describing a correspondingly larger circle. Polaris is often used in determining the exact position of the celestial pole, which may be found by halving the distance between its upper and lower culminations (q.v.). It is quite easy to find Polaris in the sky, for a line joining the two "pointers" of the Great Bear passes very nearly through it.

Police signifies (1) the judicial and executive functions of a society, and (2) an organised body formed with the object of preserving the public peace. The general features of the first of these characters are much the same in all civilised societies, but in details they differ much. Under Augustus the preservation of public peace within the city was in the hands of the *præfectus urbi*. In the palmy days of the French monarchy—for

instance, under Louis XIV.—the police depended for its efficiency upon an elaborate system of espionage. The present head of the police in France is the Minister of the Interior, to whom the *préfets* and *maires*, assisted by a huge body of commissaires and subordinates, are responsible. Under our ancient Saxon system the land was divided into hundreds, which were subdivided into tythings, and each division was responsible to that above it for the efficiency of its police arrangements. This system was supplemented by the institution of sheriffs, deputies, and a parish constabulary—an arrangement that lasted almost into our own time. In 1829 Sir Robert Peel introduced the modern metropolitan system with which we are all familiar, and in 1839 counties were authorised, and in 1856 compelled, to adopt a similar system. In Scotland corresponding changes were introduced in 1833 and 1850, and a rural police in 1857. Ireland has been treated as an exceptional country, and its public peace has long been in the hands of a semi-military body, the Royal Irish Constabulary. The United States, in the general features of their police arrangements, have followed the mother country. Police forces exist in the cities, but in the country districts the arrangements are often at a much earlier stage of development than in England to-day.

Policeman. [POLICE.]

Polignac, JULES DE, PRINCE, French statesman, was born in 1783 of an ancient lineage. His parents were driven from Paris in 1789, being rigid Royalists. Polignac organised a conspiracy against Napoleon in 1804, which failed, and he was arrested and condemned to death, but was respited through the intercession of Josephine, and suffered several years' imprisonment. On the restoration of Louis XVIII. he devoted himself to his service, and was made a Roman prince by the Pope. In 1823 he became ambassador to England, where he stayed six years, returning to Paris and assuming the position of premier under Charles X. His arbitrary conduct led to his downfall, and he fled, but was captured and again sentenced to death, which sentence was commuted. He was banished, but afterwards allowed to return to France, where he died in 1847.

Politian, otherwise ANGELO POLIZIANO (1454–94), an Italian scholar and poet, was born in Tuscany, his real name being AMBROGINI. He was wonderfully gifted as a boy, and some of his first writings are among his best. He was patronised by Lorenzo de' Medici, and was enabled to study under the greatest scholars. Lorenzo made him tutor of his son, and keeper of his manuscripts and books, allowing him to live with him. Even after he had had a serious dispute with the household, he was still sheltered by Lorenzo. At twenty-nine years of age he was a professor of Greek and Latin in Florence, and his reputation was so great that pupils and admirers came from all parts of Europe to attend his discourses. He was, however, of such an irritable and vain temper that he was always quarrelling with other scholars, Michael Angelo being of those

with whom he was at enmity. Politian published many learned works, but his poems are the best known of his writings. He translated various Greek writers into Latin, among these versions being one of the *Iliad*, which has been lost. His *Orfeo* (acted in 1483) was the first of Italian operas. Towards the close of his life he became a priest.

Political Economy. The Greek word *oikonomia* means the art of managing a household and its means of subsistence (Aristotle, *Politics*). Political economy was originally conceived of as the same sort of art applied to the resources of a state. Even Adam Smith says that "it proposes to enrich both the people and the sovereign;" but the scientific treatment of the causes of wealth, on which such an art must be based, was so developed by him and by subsequent writers that the name has come to be used for the science dealing with the general laws of the production, distribution, accumulation, and exchange of wealth, which is most conveniently defined as "material things having an exchange value."

History. The society conceived of by Aristotle as the best possible was a uniform, stable society of well-to-do households, in which agriculture would be the chief source of wealth; slaves would do most of the work, and manufacture and exchange would be comparatively limited. There would be no lending at interest, and, of course, no finance. Values and prices would vary very little, and the few free labourers that existed would receive a regular wage. Moreover, all wealth-getting would be limited by the needs of a "good life." In such a society there would be little scope for the study of economic phenomena, though some of the simplest were dealt with by Aristotle; and the society conceived of by mediæval philosophers is much of the same kind, only that slavery has disappeared, and the morally good life has become the Christian life. With the rise of great warlike monarchies towards the end of the Middle Ages we get the notion of such an art as that defined by Adam Smith (*see above*). The form it then took was the Mercantile System (q.v.). Gold and silver being the handiest form of wealth, a state, which must always be prepared for war, should try to secure as much of them as possible. The most effectual way to do so was to sell manufactured goods to foreigners for specie; and hence under Louis XIV. in France elaborate efforts were made to improve manufacture. [COLBERT.] In reaction against the restrictions this involved, the Physiocrats argued (wrongly) that manufacturing was only transforming, not creating, wealth, which had its true source in agriculture; and that the true policy was "Laissez faire, laissez passer." [LAISSEZ FAIRE.] Following them, Adam Smith attacked the Mercantile System much more elaborately, and used both economic history and abstract reasoning, and from him dates the science proper.

Adam Smith's successors—coming at a time when deductive reasoning was in fashion and society was commonly regarded simply as a collection of individuals naturally free and united under

contract—created a science dealing with wealth and man as a wealth-producer in the abstract, so that its conclusions frequently do not correspond to actual fact. Schools have, therefore, arisen (especially in Germany) which insist that the science can only be studied by observing the facts of history and society. It may, however, be answered (as it was substantially by J. S. Mill) that, without some such provisional conclusions as the "abstract" science gives us, we should be lost in the maze of economic phenomena. It would be hopeless to study the Irish land question or the fluctuations of silver without some preliminary notion of the general causes affecting rent and value. Partly in reaction against the "historical" schools, the abstract side has even been treated as a branch of the higher mathematics (especially in Austria) in a manner far too abstruse for description here. But it is well to remember that the definitions as ordinarily accepted are only provisional, and in part arbitrary, and that the deductions express rather tendencies than actual facts.

Thus the abstract schools assume a society composed of free men knowing their own interest, and each competing with his fellows to get as much wealth as possible, by producing wealth or rendering services, and selling that wealth or those services to the best possible advantage to himself. The assumption, though true in great part of modern commercial society, is comparatively remote from uncivilised or backward societies, but the deductions can easily be corrected by a study of the actual facts. Unfortunately, this correction has often been neglected; hence, in part, the outcry against economics as hardhearted and selfish. Moreover, as the science deals only with one set of the phenomena of society, other sets have to be taken into account in suggesting remedies for social ills. It is because abstract political economy alone is insufficient for this purpose that it has been called "the dismal science."

Divisions. Political economy deals with the production, distribution, and exchange of wealth. Exchange, however, and value (q.v.) are its cardinal facts. Under production and distribution (inasmuch as in England wealth may roughly be said to be divided between three conspicuous classes—landlords, labourers, and capitalists), it deals respectively with land, labour, and capital as requisites of production, and with rent, wages, and profits as the share accruing to each. These divisions are admittedly unscientific, but have not yet been quite displaced. Under exchange, it deals with the causes and nature of value and with the mechanism of trade, as money, credit, and banking; and some text-books deal also with taxation, since the goodness or the badness of the system adopted has great effect on the national wealth, or with the influence of government in general on that wealth. It must be remembered, however, that pure theory and descriptions of facts are often not clearly separated in the text-books; that the assumption of free individual competition is not true at all of many stages of society, and is still greatly modified by custom; and at present especially by the growth of joint stock companies,

by "trusts" and "rings" to control markets, and by trades' unions; and that most of the conclusions are of necessity limited in their application; but this latter objection might be made to most branches of applied science, such as engineering or pathology. [For details see RENT, BANKING, BIMETALLISM, FREE TRADE, ETC.]

Politics, in a large sense, comprise the science and art of government, and deal with all the relations of a man with the society of which he forms a unit. Now it is generally used to signify (1) the carrying on of the relations of one civilised society with another, and (2) the due appointment of legislative and executive functions, the settlement of the rights and privileges of the members, within a community itself. Hence we get the great divisions of foreign and home politics. By analogy the term is used in narrower senses still. Thus we meet with the terms "Church politics," "county politics," "village politics," and the like.

Polk, JAMES KNOX (1795–1849), eleventh President of the United States, was the son of a well-to-do farmer whose family name was originally Pollock. He received a fairly good education in early youth, and was destined for a commercial career, but he expressed such a distaste for it that his father allowed him to enter North Carolina University, where he graduated in 1818. He studied law, and in 1820 was admitted to the bar of Tennessee, of which state he afterwards became governor. He entered Congress in 1825, and remained a member for fourteen years, during which period he was several times Speaker of the Assembly. In 1844 he was elected President of the United States, and his rule is notable as that in which the annexation of Texas and California was carried out. His private life was blameless, and he was known as a stickler for punctuality, regularity, and habits of industry. A relative of his, LEONIDAS POLK (1806–64), was a notable soldier and bishop. In early life he entered the army, but left it for the ministry, becoming eventually Bishop of Louisiana. During the Civil War he espoused the Secessionist side, and was appointed major-general in 1860. He fought through various battles and gained several victories, being finally killed on Pine Mountain, in Georgia, by a cannon-shot whilst reconnoitring.

Polka, a lively Bohemian dance introduced into England from Austria about the middle of the 19th century. It is in duple time, and, generally, there is an accent on the second beat of the bar.

Pollaiuolo, ANTONIO (1426?–96), Florentine painter and sculptor, was the first to dissect the human body for artistic purposes. He was an admirable modeller, and about 1452 was working as a goldsmith in his native city of Florence. He is best known as a painter, one of his best works being in the National Gallery. His brother PIERO was also a painter of some note.

Pollen is the special name of the microspores of Phanerogamia (q.v.). It consists generally of minute dust-like *pollen-grains*, each of which is a microspore formed from a single cell, one of four daughter-cells resulting from the division of a

pollen mother-cell. Sometimes, from the non-solution of the wall of the mother-cell, the grains remain connected. In different divisions of the Orchidaceæ (q.v.) all gradations occur from isolated grains, through *tetrads* or groups of four, to *pollinia* or *pollen-masses*, in which all the grains of each anther-chamber are united. The wall of the ordinary pollen-grain becomes differentiated into an outer cuticularised exospore, *exine* or *extine*, and an inner cellulose *intine*. The former often projects in spiny points, ridges, etc., and the latter is locally thickened inwards. In Gymnosperms the pollen-grain divides into two unequal cells, of which the larger grows out into the *pollen-tube* on pollination and the smaller commonly divides into several *included cells*, the male prothallium (q.v.). In pines the exine is distended into air vesicles. In Angiosperms the grain similarly divides into two primordial or wall-less cells, from one only of which the pollen-tube is formed when the grain reaches the stigma. Several pollen-tubes may issue from one grain, each being a projection of the intine, rendered possible by the above-mentioned thickening. The contents of the grain do not form antherozoids (q.v.), as in the microspores of Cryptogamia, but two nuclei pass into the tube. The exine is sometimes sticky from an oily exudation.

Pollination is the conveying of the pollen from the anthers to the tercine in Gymnosperms or the stigma in Angiosperms, where it is detained by viscosity. Pollination may be effected by wind, as in the *anemophilous* (q.v.) flowers of Coniferæ, hazels, etc.; by insects, as in more showy, coloured, variegated, odorous, or honey-secreting *entomophilous* flowers; or, more rarely, by birds, slugs, beetles, or running water. It may precede fertilisation (q.v.) by a few hours, or, as in conifers, by months. [FERTILISATION.]

Pollio, CAIUS ASINIUS, Roman orator (b. 76 B.C., d. 4 A.D.), was known as an orator before Cæsar's war with Pompey. He espoused Cæsar's cause and, after the latter's death, sided with Antony, who named him consul (40 B.C.). He reconciled Augustus and Antony, was known to Horace and Virgil, who dedicated poems to him, and retired from public life after his victory over the Dalmatians. He founded a public library in Rome.

Pollock, SIR FREDERICK (1783–1870), English judge, was born in London, and was the son of a saddler. He was educated at St. Paul's School, and afterwards entered Trinity College, Cambridge, where he graduated as Senior Wrangler in 1806. Studying law, he was called to the bar in 1807, and for twenty years practised with great success in London and on the Northern Circuit. He was first made a king's counsel, and, becoming member of Parliament for Huntingdon, was appointed Attorney-General in 1834 and received knighthood. In 1841 he again became Attorney-General, and three years later was made chief baron of the Court of Exchequer and a privy councillor. In 1866 he retired from the bench, and was made a baronet. He was one of the most distinguished ornaments of the English bench during the century; his decisions were as clearly

expounded as they were generally sound. Few lawyers possessed in such a high degree the gift of lucid expression. He was twice married, first in 1813, and secondly in 1835. By each wife he had a large family. His grandson and namesake, the present baronet, is Corpus Professor of Jurisprudence at Oxford, and has written valuable legal and other works.

Poll Tax was a tax of the Middle Ages, which, as its name implies, was levied upon each member of a community. In England it amounted to three groats upon all over 15, and was a most unpopular tax. It was levied in 1377 and in 1380, and in 1381 the arbitrary conduct of those to whom the tax was farmed out caused much disturbance, notably that of which Wat Tyler was the moving spirit. King William III.'s hearth tax, the window tax of a later period, and the income tax of our own time are the nearest modern counterparts.

Polo, an equestrian game of hockey, was practised from a remote antiquity in the East, and was introduced into Calcutta by British officers in 1863. It has now been generally adopted among British communities. The polo-ground should be of turf, 300 feet by 200 feet, with goals at each end 22 feet apart. The ponies used should not be more than fourteen hands high, nor the players more than four a side, consisting of 1, 2, 3, and back. The polo-stick—four feet long—is of light cane, with a cross-head eight inches long, and the ball is of light wood. A player is not allowed to cross the front of his opponent.

Polo, MARCO (1255–1323), the great traveller, was born in Venice shortly after his father and uncle had gone on a voyage to the East. They were away for many years, and visited the Tartar Emperor of China or Great Khan. He was interested in their stories of Europe, and in order to ingratiate himself with the Pope, of whose power he had heard, entrusted them with a mission to him, requesting that a hundred learned men might be sent to China to convert its people to Christianity. They returned to Italy after many years' absence, and found Marco grown up. Owing to internal dissensions, the Papal chair was vacant, and a long time elapsed before they were able to get the sanction of the Papacy. They returned to China with Marco, loaded with presents for the Khan, who gave them a royal reception. Marco Polo became a favourite with the Khan, who sent him on various embassies. At length they found an opportunity of returning to their native country. They were appointed to escort the Khan's granddaughter to Persia, where she was to marry a young prince, and promised to return; but the voyage proved so tedious that the prince was dead before they reached him. Feeling absolved from their promise by the death of the Khan, they went to Italy, where they arrived in 1295, with the enormous wealth they had been given. In Venice they were regarded as wonders. Marco Polo was made commander of a galley in an expedition against the Genoese, and, being defeated, was imprisoned for a long time in Genoa. Here he wrote the marvellous story of his

travels in the East, giving glowing descriptions of the magnificence of its potentates and of the people. He was liberated and returned to Venice, where he died in 1323. Many of his extraordinary statements were scoffed at in his time, but time has proved their truth. It was the reading of his *Description of the World's Wonders* which inspired Columbus to seek a new world. Polo's travels have often been edited and translated.

Polyandrous, literally "having many male organs" or stamens, applied strictly to those flowers in which there are twenty or more stamens, and their insertion is on the receptacle (*thalamifloral*) as in the Ranunculaceæ (q.v.), poppies, water-lilies, mignonettes, rock-rose, linden, etc. Where there are a similar number with "calycifloral" insertions [ROSACEÆ], they were termed in the Linnæan arrangement *icosandrous*.

Polyandry. [POLYGAMY.]

Polyanthus, a garden name, meaning "many-flowered," applied to those cultivated varieties of the primrose (q.v.) in which the peduncle is elongated bearing up a whole umbel of flowers, as is normally the case in the cowslip. The flowers are variously and beautifully tinted, often having a broad circular band of red or brown, with a yellow centre or "eye," and sometimes an edging or "lacing" of a different shade. They are old-fashioned cottage-garden favourites.

Polybius (204?–122 B.C.), Greek historian, was born at Megalopolis, and was the son of Lycortas the statesman. He became connected with politics in his youth, and was one of the thousand hostages carried off by the Romans after the conquest of Macedonia in 167 B.C. He formed the acquaintance of Scipio, the destroyer of Carthage, who aided him in his historical studies. Polybius returned to Greece in 151 B.C., and soon after that was again with Scipio, returning finally after the Romans had conquered it. Though he has been reproached with deserting his country, it is certain that he rendered it great service on account of his influence with the Romans. His great work is a history of Greece and Rome between 220 and 146 B.C. in forty books, of which only four or five remain, except in fragments. It is accurate, impartial, and admirably written, and has been often translated.

Polycarp, SAINT, martyr, and Bishop of Smyrna, was instructed in the Christian religion by the apostles themselves, and became attached to John the Evangelist, who made him Bishop of Smyrna in 96 A.D. There is nothing known of St. Polycarp's early life or of his personal history, but he was probably born in Asia Minor. He ruled his see for many years, and received St. Ignatius when the latter journeyed from Antioch to Rome. In the year 158, then a very old man, he went to the Holy City to confer with Pope Anicetus about the celebration of Easter Day. He objected to the Western practice of holding it on the anniversary of the resurrection, but the result of the conference was simply to leave the East and West to their former methods of celebration. While in Rome Polycarp

converted many of the followers of Marcio and Valentine from their heresies. He was held in the highest reverence by Christendom, and was considered head of the Asiatic bishops. He held the see for seventy years, and at length was ordered to be burnt by the Roman Governor for refusing to renounce Christ. His reply was, "Eighty-and-six years have I served Him, and He never did me wrong, and how can I betray my King who saved me?" His bones were gathered by his disciples and preserved. The record of his martyrdom is to be found in the letter from the Christians of Smyrna to the church of Pontus. His beautiful *Epistle to the Philippians*, though its authenticity has been disputed, is a noble relic of the times.

Polychæta, the order of worms including those members of the class Chætopoda or bristle-bearing worms which have numerous setæ or bristles; these are united into bundles and placed on lateral processes of the body known as parapodia. In addition to these, there are other lateral appendages—the cirri and branchiæ—which are mainly concerned in respiration. The Polychæta are all marine. The order is subdivided into the Errantia, which are free and carnivorous; and the Tubicola, which live in tubes which are usually fixed; while the animals feed on vegetable matter. As examples of the former may be cited *Aphrodite*, or the Sea-hare, and the centipede-like worms, *Nereis*, *Phyllodoce*, etc.; of the latter there are the Lob-worms (*Arenicola*), which live in burrows in sand, and *Serpula* or *Spirorbis*, which form calcareous tubes.

Polycistina, a name often used for those Radiolaria (q.v.) which have a siliceous shell.

Polycladida, a family of flat, leaf-shaped worms, with much-branched intestines, belonging to the order Dendrocœlida (q.v.) and the class Turbellaria. They are all marine, and of interest, as they are supposed to have possible affinities with the Jellyfish belonging to the class Ctenophora (q.v.). This view is based on the position of the auditory organ, and of some bands of cilia in some Polyclads. The structure of the excretory and nervous systems is, however, opposed to such a view.

Polycrates, tyrant of Samos, obtained power over that island about 532 B.C. Having put to death or otherwise removed those who helped him to power, he began to extend his dominion, endeavouring also to render it impregnable. He sent troops to the aid of Cambyses, who was invading Egypt; but those he sent, co-operating with Spartans and Corinthians, laid siege to Samos without success. He was eventually betrayed by one of his enemies, Orætes, who, by false pretence, enticed him out of Samos, when he was captured and crucified (522 B.C.). He was a patron of art and literature, Anacreon being one of those patronised by him.

Polygamous, in botany, signifies "having flowers both perfect and imperfect (*i.e.* bisexual and unisexual) on the same plant," as in the ash, the maples, horse-chestnuts, and most Compositæ (q.v.). The horse-chestnut illustrates a common

principle, the lower or first-formed flowers being bisexual, or having both stamens and carpels; while the upper, later-formed ones are male, *i.e.* staminate. In the Compositæ various arrangements occur, the most frequent being that in the daisy, where the centre or disk florets in each head are bisexual, and the outer or ray florets are female, *i.e.* pistillate.

Polygamy, though generally restricted to the kind of marriage in which one man has many wives, should also include Polyandry, in which one woman has many husbands. [FAMILY, MARRIAGE.] In Africa and the East polygamy, in the strictest sense, is still prevalent; and by the Koran (chapter iv.) a man is permitted to have four wives. In Old Testament times a plurality of wives seems to have been the rule. Lamech (Gen. iv. 19) had two; and the maximum was probably reached by Solomon (1 Kings xi. 3). One finds no word of reprobation as to the enormous number; his blameworthiness seems to be due to the fact that they were "strange women." Probably, as in the harems of Eastern potentates at the present day, the vast majority were wives in name only, some few favourites sharing the affection of their lord. Christianity condemns polygamy, though in the religious upheaval of the 16th century some of the chief German reformers sanctioned it in a particular case (that of the Landgrave of Hesse). Polygamy was distinctly advocated as a remedy for prostitution by the Rev. M. Madan, who in 1780 published *Thelyphthora: or, a Treatise on Female Ruin*, to spread his views. This drew from Cowper his *Anti-Thelyphthora*, which Canon Benham, the editor of the *Globe* *Corper*, justly calls "a wretched production." [MORMONS, BIGAMY.]

Polygon is any figure whose sides are straight lines; when these sides are all equal and include equal angles, the polygon is said to be regular. All regular polygons can be circumscribed to and inscribed in a circle, but the problem is not always easy of solution. Euclid devised methods for performing the operation with polygons of 3, 4, or 5 sides; and hence the method can be applied to cases where the number of sides is 3, 4, or 5 multiplied by any power of 2. Gauss gave solutions for polygons of a more complicated type. All polygons of an even number of sides, if circumscribed about a circle, have the sums of the odd and even sides equal; and, if inscribed in a circle, the sums of the odd and even angles are equal. The sum of the angles of any polygon is equal to four less than twice as many right angles as the figure has sides.

Polygon of Forces, a polygon of which each side represents in magnitude and direction one of a number of forces acting on a point. When the forces are in equilibrium, the polygon is complete.

Polygordius, the type-genus of the family *Polygordiidae*, and the best-known member of the class of primitive worms known as the Archi-Annelida (q.v.). It is a small marine worm, with the segmentation very feebly marked; they have neither bristles (setæ), lateral appendages (parapodia), nor the respiratory processes known as

cirri and branchiæ. The intestine is straight, and the kidneys (nephridia) also very simple. The fact that the nerves are retained in the hypodermis is another very primitive character. There are several species which are common in the Mediterranean; when irritated, they break voluntarily into fragments.

Polyhedron is a solid figure bounded by plane surfaces. If its faces are all equal and regular polygons, it is said to be a regular polyhedron, and it can be shown that only five such can exist—*i.e.* the tetrahedron (four faces), cube (six faces), octahedron (eight faces), dodecahedron (twelve faces), and icosahedron (twenty faces). The prism and pyramid are common examples of irregular polyhedra. A connection between the number of faces, edges, and vertices of any polyhedron is given in Euclid's theorem, which states that the sum of the number of faces and vertices is two more than the number of edges.

Polymerism. Many chemical compounds exist which possess similar percentage composition, but which contain different numbers of the constituent atoms in their molecules, and hence possess different molecular weights and different vapour densities; such compounds are said to be polymeric. As examples are the class of compounds known as *olefines*, all of which possess the same percentage composition (*i.e.* C 92.3, H 7.7), but which vary in their molecular weights from 26 (C_2H_2) to 420 ($C_{30}H_{60}$). Many compounds, especially a number of hydrocarbons, if allowed to stand (especially if warm), polymerise and pass into these higher compounds.

Polymorphism is the modification of different members of a colony into very different forms, whereby a division of labour is secured to the colony. Thus, in the common Sea-firs or *Sertularia*, some of the individuals which form the colony are specialised for the capture and digestion of food, and others for reproduction; the former are known as hydrothecæ, and the latter as gonothecæ or gonangia. As in this case there are only two modifications, it is known as dimorphism; in others it is more complex. Thus, in the Physophoridae (q.v.), some individuals form the feeding members or "polypites;" others form a "pneumatophore" or float; a third set serve as protective plates or "hydrophyllæ;" a fourth, the feelers or "hydrocysts;" a fifth, the male reproductive organs or "androphores;" and a sixth, the female or "gynophores." Polymorphism is especially characteristic of the Cœlenterata, as in the Sponges, Sea-firs, and other zoophytes, and the Alcyonarian corals. Amongst higher animals, it occurs in the order Cheilostomata of the class Bryozoa, where the individuals that serve for feeding and digestion, for reproduction (oœcia) and protection (avicularia), are all modified zoœcia.

Polynesia (Greek *polus*, "many," and *nēsos*, "island"), a term often used vaguely to designate all the islands of the Pacific Ocean, but restricted by many geographers to the groups lying between the tropics and E. of the Philippines and New

Hebrides. From this point of view, *Polynesia* includes the Tonga, Samoa, Cook, Marquesas, and Society Islands; whilst the New Hebrides, Solomon, Fiji, Queen Charlotte, and Loyalty Islands, with New Britain and New Caledonia, are classed under the title *Melanesia*, *Micronesia* being the name given to the small islets dotted about to N. and N.W. of these groups, the *Sandwich Islands* forming an independent cluster. In its extended sense, *Polynesia* is much the same as *Oceania*.

Polynesians—collective name of all the South Sea or Pacific Islanders, practically synonymous with *Kanaka* (q.v.)—comprise three main ethnical groups: Indonesians, Micronesians, and Melanesians (q.v.). In a more restricted sense, the term is applied in recent ethnological works to the large, brown natives of the eastern archipelagoes (Hawaii, Marquesas, Tahiti, Samoa, Tonga, New Zealand), who are a branch of the Indonesians, presenting great uniformity both of type, speech, and national traditions. [For details see under the several entries.]

Polypetalous, having the petals distinct, as opposed to gamopetalous (q.v.). Though among Monocotyledons this is often only a generic character—as, for instance, in distinguishing squills from hyacinths—among Dicotyledons it is of much greater systematic importance, distinguishing a whole sub-class, the *Polypetalæ*.

Polyphemus, most terrible of the Cyclops, was the son of Neptune, and was of fearful aspect. He was smitten with Galatea, and killed Acis, his more fortunate rival. The *Odyssey* describes how Ulysses, who was shipwrecked on his island, dispatched the monster by thrusting a burning pole into his single eye.

Polyplacophora is the order of Mollusca which includes the Chitons in which the body is protected by a shell formed of eight overlapping plates. The group is of great geological antiquity, and includes some of the most primitive of living Mollusca. The body is bilaterally symmetrical, and the organs are all paired and metamerically repeated; this may be a trace of segmentation in the ancestor of the Mollusca.

Polytechnic is an institution where instruction—especially practical teaching—is given in various arts and branches of knowledge. In 1794 a polytechnic school was founded in Paris, and this has been largely imitated, especially in Germany and America. The "Polytechnics," of which several are now established in London, are of a more popular character than those abroad.

Polyzoa, a term proposed by J. V. Thompson for the individual zooids or cells which form the constituent elements in those zoophytes or plant-like animals which are now included in the class Bryozoa (q.v.). The term has, therefore, been used by some English naturalists as the name of this class.

Pombal, MARQUIS DE (DON SEBASTIANO JOSÉ DE CARVALHO), a great Portuguese statesman, was

born in Coimbra in 1699. After trying the law and the army, he went to Lisbon, and was well received at court. In 1739 he became ambassador to England, being recalled in 1745, and in 1750 was made foreign secretary. The great earthquake of 1755 roused his energy, and he did wonders for the country, making a clean sweep of many abuses. His severity was tempered by judicious concessions, and he carried out a good system of national education, and did much for native industries. He was the confidant of Joseph I., who created him Marquis; after the king's death his enemies forced his removal, and he died on his property in 1782.

Pome, the fruit characteristic of the sub-order Pomaceæ in the order Rosaceæ. It is inferior and pseudocarpic, the carpels being surrounded by a fleshy external prolongation of the floral receptacle. This may exceptionally contain one carpel only, as in one variety of the hawthorn (q.v.), *Crataegus Oxyacantha* (variety *monogyna*); or two, as in the variety *oxyacanthoides*; but more often five, as in apple, pear, mountain-ash, medlar, etc. The carpels form the core and may be distinct from one another, though embedded; and may be either stony, as in the medlar or hawthorn, or parchment-like, as in the apple and the pear. The pome is surmounted by the withered calyx, which in the medlar is large, and is not carried so nearly to the apex as usual. In the pear much of the peduncle is fleshy below the carpels. The fleshy part of the pome in this species contains woody particles; that of the hawthorn is of a mealy consistence.

Pomegranate (*Punica Granatum*), the only species of an isolated genus of uncertain affinities, long valued in hot countries for the refreshing pulp of its fruit. It is a tree, 15 to 25 feet in height, native to West Asia and North Africa. Its opposite, simple, entire leaves have neither the glands nor the infra-marginal vein characteristic of the Myrtle order. The flower has five scarlet or white petals, an inferior ovary, and a valvate calyx. The fruit is unique in having two whorls of carpels, three or four below, and from five to ten above, with a tough leathery gold-coloured, but partly reddened, exterior, and numerous seeds each surrounded by a reddish pulp. This varies in flavour in the numerous cultivated varieties. The rind is rich in tannin, and is employed in tanning Morocco leather.

Pomerania (German *Pommern*), a province of Prussia, is bounded N. by the Baltic, W. by Mecklenburg, S. by Brandenburg, and E. by West Prussia, and has an area of 11,620 square miles, being divided into the districts of Stralsund, Stettin, and Köslin. Formerly an independent duchy, it was in 1648 partitioned between Sweden and Brandenburg. In 1814 the Swedish share was allotted to Denmark, but Prussia ultimately acquired the whole. The country is very flat, but the soil is fairly productive, yielding potatoes, rye, oats, and in parts wheat, beetroots, and tobacco. Pomeranian geese enjoy high repute throughout Germany. Forests, abounding in game, and great shallow

lakes cover much of the area. The Oder with its tributaries drains the province into the Stettiner Haf, on which Stettin, the capital, is situated.

Pompadour, MARQUISE DE (JEANNE ANTOINETTE POISSON), courtesan, was of humble origin, and was born in 1722. She married at the age of nineteen a M. d'Etioles, and her beauty and charming manners attracted one day the attention of the licentious Louis XV., whose favourite mistress she immediately became. She gained very rapidly a complete ascendancy over that worthless monarch, and ruled both him and his kingdom. Her imperious and vindictive conduct and her tremendous influence were visible in the wholesale manner in which she doomed hundreds of people to life-long imprisonment for daring to object to her actions. She even heartlessly allowed those perfectly innocent of that mistake to languish many years in dungeons. In 1745 she was made a marchioness, and her shameless conduct in ministering to all the king's depraved tastes is a matter of history. In defiance of all etiquette, she persisted in spending her last hours at Versailles, and on her death-bed forced the king to carry out her instructions with regard to her favourites. The French Revolution has been not unnaturally considered the result of the corruption and tyranny of Louis XV.'s reign.

Pompeii, a seaside town in Campania on the Bay of Naples, and at the foot of Mount Vesuvius, towards the end of the republic became a favourite resort for wealthy citizens. In 63 A.D. it suffered severely from an earthquake. Before it could recover from this calamity an eruption of Mount Vesuvius in 79 A.D. buried the whole town in volcanic ashes so effectually that the very site was forgotten. It was not until 1748 that an accident revealed its existence. The city had a circumference of about two miles, and was girt by a wall with towers at varying intervals and eight gates. In this area, besides many private villas and shops, have been discovered a forum, an amphitheatre, a theatre proper, temples of Hercules, Jupiter, and Venus, etc., public baths, and markets. The streets, intersecting one another at right angles, are very narrow, and the architecture, distinctly Greek, is marred by the poorness of building materials. Most of the relics found in the city are collected at the Museo Borbonico at Naples.

Pompey the Great (CNEIUS POMPEIUS MAGNUS), a famous Roman general and statesman, was born in 106 B.C., and was the son of Cneius Pompeius Strabo, under whom he commenced his military career. His father getting into trouble, the house was attacked during the Marian tumults in Rome, and Pompey did not re-enter public life till after Marius' death. He raised some legions and went to the assistance of Sulla, who was then carrying on his Mithradatic War. Sulla welcomed him warmly, and gave him shortly after his step-daughter in marriage, Pompey basely repudiating his lawful wife. He was sent by Sulla to Sicily, to Africa, and elsewhere, against the Marians, whom he defeated. Sulla made him one of his legates, and surnamed him Magnus. After Sulla's death

he quelled the revolt of Sertorius in Spain and put an end to the Servile War, and in 70 B.C. he and Crassus were made consuls. Special powers were subsequently conferred on him for the suppression of piracy in the Mediterranean, and for the conduct of the Mithradatic War. He crushed the pirates in three months, routed Mithradates' army, and made Pontus a Roman province, conquered Jerusalem, and returned to Rome in 62 B.C. He might then easily have risen to the height afterwards attained by Cæsar, but he had not the political ability or readiness requisite for acting alone. Joining, therefore, with Cæsar and Crassus in a league against the senatorial rule, he became sole consul after the death of the latter. Cæsar and he became enemies and a war commenced, in which Pompey posed as the champion of the senate and the constitution. Cæsar, who knew Pompey was unprepared, followed him to Greece, and totally defeated him at Pharsalia. Seeking refuge in Egypt, Pompey was assassinated there in 48 B.C. Despite his many bad qualities, Pompey was a great military genius.

Ponce de Leon (1460-1521), a navigator and soldier, was the descendant of a noble family of Aragon, and in his youth was a court page. It is supposed that he accompanied Columbus in 1493 on his second voyage to Hispaniola, but there is some doubt about this. Obtaining permission to attempt the conquest of what is now Porto Rico, in 1508 he went there, and returned with samples of its gold; became governor of the island in 1510, and completely conquered it soon after. He was deprived of his post in 1512, and went on several expeditions, discovering Florida on one of his voyages. He tried to conquer it, but was defeated, and died of his wounds at Cuba, to which he had retired. There is a monument to him in Porto Rico.

Pondicherry, a French settlement on the Coromandel coast of India, 86 miles S. of Madras. The territory, which takes its name from the town, has an area of 112 square miles, and is divided into three districts. Pondicherry was first occupied by the French in 1674, and has been four times besieged by the English; captured in 1793, it was restored in 1816. The native and European inhabitants occupy separate quarters; and the place is well laid out, abundantly supplied with water, and fairly healthy. It contains a cathedral, a college, and a residence for the governor, and is defended by a citadel.

Pondos (AMA-PONDO), a branch of the Zulu-Kaffirs who, in the national genealogies, claim descent from Zuide, founder of the nation, through Mpondo, brother of Xosa, who flourished in the 16th century. They occupy a semi-independent territory (Pondoland), about 4,000 square miles in extent, with a population of 200,000, at the south-east extremity of the continent between Cape Colony and Natal. They have maintained relations with the English since 1824, when they appealed for aid against Chaka, founder of the Zulu empire. In 1865 Taku, reputed over-lord of all the Pondos, practically accepted the British protectorate; but,

despite their engagements to live in peace and discontinue sanguinary rites, there has lately been a recrudescence of the atrocities connected with the still prevalent belief in witchcraft. The country also continues to be distracted by tribal wars; and in January, 1894, the paramount chief, Siegau, descendant of Taku, was defeated with much slaughter by Partakala, the powerful chief of the Unzizi tribe. In consequence of these disorders, Pondoland was in 1894 annexed by Great Britain.

Poniatowski, JOSEPH (1763-1813), a Polish prince and general, was the nephew of Stanislas, last king of Poland (q.v.), who died in 1798 and who was deprived of his kingdom by the Russians and Prussians, in spite of their most emphatic promises to support him and Polish independence. Joseph Poniatowski entered the army, and soon became distinguished by his prowess. He was made commander-in-chief of the Polish army, and fought through many campaigns, assisting Napoleon most effectually against Russia. Napoleon made him a Marshal of France in 1813, but on the whole treated him shabbily. Poniatowski's valour and strategy gained many a victory in the war which closed with the subjugation of his native country. He was drowned during the flight after Leipzig, leaving behind him a brilliant reputation as a soldier.

Pontefract, or POMFRET, a municipal and parliamentary borough in the West Riding of Yorkshire, 24 miles S.W. of York, and on the river Aire, near its junction with the Calder, with a station on the Lancashire and Yorkshire Railway. It is a finely-situated and well-built town, notwithstanding its antiquity. The old castle, founded in the 11th century, the scene of Richard II.'s murder, was reduced to ruins by the Parliamentary army in 1649. All Saints' church has some remains of 12th-century work, and St. Giles's shows traces of Norman architecture. Liquorice is grown in the neighbourhood for the manufacture of Pomfret cakes, and there are iron-foundries, brick and terracotta works, tanneries, and breweries. Till 1885 the borough returned two members; it now has one.

Pontifex, in ancient Rome, was the name given to priests of the nation attached to no particular cult, but exercising a general supervision over them all. The office is said to have been instituted by Numa, and the college consisted of five, presided over by the High Priest or Pontifex Maximus. In 300 B.C. the number was increased to nine, including the Pontifex Maximus, and four of them had to be elected from the plebs; under Sulla they numbered fifteen, and in the time of Julius Cæsar sixteen. They formed a kind of State Episcopate; and among their chief functions were the inauguration of priests, securing the due observation of Vesta's rites, taking care of the public annals, administering ecclesiastical law, regulating the calendar and public worship. Their distinctive dress was the toga prætexta and a conical hat made from the skins of sacrificial animals. The post of Pontifex Maximus was occupied till the time of Theodosius by the Emperor, and from that time by the Pope.

Pontifical, a book of the Roman Church, containing the prayers and rites used upon various occasions by Popes and bishops. It is said to have been first compiled by Pope Gelasius, and to have been re-edited by Gregory the Great. The present pontifical was published by Clement VIII. in 1596.

Pontoon, a flat-bottomed boat, or other equivalent contrivance, used in military engineering for supporting a floating-bridge to afford passage to troops. The most usual forms are a decked cylinder or an undecked boat. The pontoon, as last modified for the English army, consists of a light, half-decked boat of thin wood, covered with canvas. The modern pontoon is the production of the 18th century, but floating bridges were used by Darius, Xerxes, and other ancient campaigners.

Pontus, a name given to a district in the N.E. of Asia Minor on account of its proximity to the Euxine. Originally part of Cappadocia, it became a separate satrapy, and was finally erected into a kingdom by Ariobarzanes early in the 4th century B.C. Pontus next became a Roman province in 60 B.C., on the defeat of Mithradates. The western half and the coast from Trebizond to the mouth of the Halys were fertile and civilised.

Poodle, a breed of dogs, introduced into Britain from the Continent early in the 19th century. They are affectionate and intelligent, and, from the readiness with which they learn tricks, they are often trained by showmen as performing dogs. There are two principal varieties: the white and the black (the larger of the two). The coat is thick and mat-like, and is generally shaved or clipped, so as to give the dogs a grotesque appearance. The White Poodle makes a good house-dog, and the Black Poodle is not only a faithful companion, but a good water-dog and retriever.

Pool, a game played by an unrestricted number of players upon a billiard table. It is played with a white and many coloured balls, which are drawn by the different players; the white ball is spotted, and the holder of red plays upon white, and the remaining colours in order upon each other, according to their succession upon a board in the room; each player starts with three lives. If the player hits the ball he plays upon and holes it, the owner of that ball loses a life; if the player gives a miss, or holes his own ball, he loses a life. The first to lose three lives has the opportunity of *starring*, i.e. he may buy a fresh supply of lives, not exceeding the smallest number of lives remaining in the pool. When two players only remain, it is usual for them to divide the pool. There are several varieties of the game.

Poonah, a district and its capital in the Bombay Presidency. The former has an area of 5,347 miles, and, being situated on the plateau of the Deccan, enjoys a dry and healthy climate. It is broken by spurs from the Ghats to the west, but the eastern part is level and fertile. Railways connect it with Bombay and with Madras. The chief river is the Bhima, flowing N. to S. The

town of Poonah stands on a bare plain, 2,000 feet above sea-level, and close to the Ghats, being 80 miles S.E. of Bombay. Besides the administrative buildings, there are cantonments for a large force, a Government college, and other institutions.

Poor Laws are those provisions which are made in Great Britain for regulating the support of the indigent poor. The need of them was hardly felt before the Reformation, since the monasteries and religious houses supported great numbers, while the Church encouraged alms-giving as a pious practice. Hence, each neighbourhood easily supported its own poor. Under Henry VIII. the question began to be pressing, and was met by parochial collections under legally authorised clerical pressure. In 1601 the Act 43 Eliz. began the foundation of our present poor law system by creating overseers who had power to raise money to grant in sums for relief, or to provide work for the poor. Workhouses became general under an Act of 1723; unions of parishes were authorised in 1782. Later, especially during the French wars, out-door relief became prevalent, the justices were made the relieving authority (1815), and (in the country) paupers were commonly assigned as labourers to the various farmers in a parish. The relief thus kept wages down, and was given so recklessly that rates in some parishes reached 20s. in the £. The system "discouraged thrift and acted as a premium on vice." The Act of 1834, passed as the result of a Parliamentary Commission, established the present system in outline and instituted a central control, vested since 1871 in the Local Government Board. The discretion of giving either out-door or in-door relief has existed since 1834. The Scotch and Irish systems closely approximate to that of England.

Pope, a title applied in the Eastern Church to all priests, and in the ancient Western Church to bishops, being however gradually appropriated in the Western Church to the Bishop of Rome. The position of the Pope *par excellence*, i.e. the Bishop of Rome, has for ages been a matter of hot controversy. In the 5th century the Pope was generally recognised as *primus inter pares*, and in 449 Leo the Great claimed supremacy upon Scriptural grounds. The question of supremacy caused the Great Schism in 1054. To give a history of the Popes would be to give a general political history of Europe. It must suffice to say that Gregory I. and Leo III. were greatly instrumental in building up the Papal power, while Innocent III. (1198-1216) put the final touches to the edifice. He it was who laid the foundations of the temporal power by claiming as lord paramount the title to lands the possession of which had its origin in a grant made by Pepin. The full claims of the Papacy are to a universal spiritual supremacy and to a large territorial sovereignty. Since the loss of the temporal power the Pope has confined himself to the Vatican. The doctrine of Infallibility, the force of which is greatly misunderstood, dates from 1870. Leo XIII.—258th Pope—was born in 1810, and succeeded in 1878.

Pope, ALEXANDER (1688-1744), English poet, was born in Lombard Street of Roman Catholic parents. His father was a linen merchant, and his mother belonged to an old family. After the Revolution of 1688 they retired from business, and went to live on a small property in Windsor Forest. A priest attached to the family taught the boy Latin and Greek; and, being of a sickly and delicate nature, Alexander gave up most of his time to reading and writing, and was able to write verse at a very tender age. His first school was at Twyford, but he was afterwards sent to an establishment at Hyde Park Corner. His father gave him every encouragement to continue to write, and seemed to take pride in his son's proficiency in rhyme. For Dryden the boy had a great admiration, and counted it one of his happiest moments when he managed to see "glorious John." He began to study French and Italian literature, and continued to produce much poetry. His pastorals, which appeared in 1709, had been written much earlier. Through Sir William Trumbull he made the acquaintance of several of the leading writers of the day, notably Congreve, Gay, and Wycherley. His *Essay on Criticism* (1711) led to a slight friendship with Addison, which was not long in duration. The intimacy contracted with Swift remained unbroken till death. Though only twenty-five, he had already become well known, and his *Rape of the Lock*, *Windsor Forest*, and other works made him one of the greatest poets of his time. He wrote the prologue to Addison's *Cato*, and began to work on a translation of Homer which he had long meditated. Swift assisted him greatly with his influence, and the first volume was published in 1715, the other volumes appearing between that date and 1720. By this work, which is still read with pleasure, and is indeed an English classic, Pope is believed to have made at least £5,000. His father died in 1717, leaving little money to his son, and in the same year a collection of the latter's miscellaneous pieces appeared, and were much admired. He was now generally recognised as one of the great poets, but was always subject to attacks from the smaller fry of literature, who knew his sensitiveness to criticism and satire. In 1725 his version of the *Odyssey* came out, and from this work, in which he had been assisted by one or two other writers, he is supposed to have obtained several thousand pounds also. He had not forgotten the abuse of the Grub Street writers, and in 1728 appeared his scathing satire of the *Dunciad*, into which are introduced all his enemies, and also other writers who hardly deserved such treatment. In later editions he included others whose envy he had aroused or whom he disliked. His brilliant *Epistles* came out soon after the *Dunciad*, and in 1732 he published the first part of his famous *Essay on Man*, the rest following at a subsequent period. His health, which had always been bad, grew worse previous to 1740, and on May 30th, 1744, he died in the beautiful villa he had purchased at Twickenham. He was buried in the parish church of that place. Pope will always remain one of the most popular of English poets. Few writers have

had his gift of clear expression and his epigrammatic brevity to such a degree, and his lines are usually so pointed and smart that they remain in the memory and have in many cases become proverbs. In satirical power he has had few equals, and there is much *verve* and brightness in his descriptions. He holds a high rank, too, as a prose-writer, his *Letters* being among the best in the language.

Poplar, the English name for the trees of the genus *Populus*, which belongs to the Willow tribe, and is distinguished by its broad leaves on long, vertically-compressed leaf-stalks, jagged catkin-scales to both male and female catkins, rudimentary perianth-tube, numerous stamens, and cottony seeds. Poplars are quick-growing trees, forming soft wood, of little use except for paper-pulp; but several species are ornamental trees. *P. alba* (the White Poplar or Abele), *P. canescens* (the Grey Poplar), *P. nigra* (the Black Poplar), and *P. tremula* (the Aspen), are natives of Britain. *P. fastigiata*, the Lombardy Poplar, a variety of the Black Poplar, with fastigate or vertical branches, reaching a height of 100 to 150 feet, and now forming a familiar change to what might be monotony in our landscape, is of recent introduction. In North America poplars are known as "Cottonwoods." The so-called Black Italian Poplar (*P. monilifera*) and the Tacamahac (*P. balsamifera*), are natives of that continent commonly planted in England.

Poplin, a woven material, consisting of a silk warp and a woollen weft; sometimes, however, cotton and flax are substituted for silk. The manufacture, which is one of the staple industries of Ireland, was introduced into that country by French refugees in 1775.

Poppy, the genus *Papaver*, the type of the order Papaveraceæ, a small group of herbs with a milky juice; fibrous roots; generally lobed leaves; ebracteate axillary flowers, with two or three caducous, half-equitant sepals; four or six crumpled petals; numerous stamens, often black; and a syncarpous ovary, with radiating stigma, forming a many-seeded pore-capsule with partial septa. Four species with scarlet flowers are common weeds in cultivated ground in England; but are susceptible to frost which suggests an exotic origin. The most important species is *P. somniferum*, the opium poppy, supposed to be a native of the Levant, but now widely grown, in part as a garden flower. It is an erect annual, two to five feet high, entirely glaucous, with sinuous sessile leaves and petals of various colours, but most commonly white or violet, and often double. The flower bud is pendulous. From the capsules in this country *syrup of poppies*, a powerful sedative, the anodyne fomentation, the *decoction of poppy-heads*, and an extract, are prepared; but in India, Persia, Egypt, etc., the plant is grown mainly for the manufacture of *opium*, which is obtained by incisions in the unripe capsules whence the latex (q.v.) exudes and coagulates. India exports about 6,500 tons of opium to China annually, valued at ten million sterling. We import about 250 tons, chiefly from

Turkey and Persia, for medical purposes. The seeds yield nearly 50 per cent. of a valuable, pale golden, scentless oil of agreeable taste, not narcotic, used by painters, in India in cookery, and as an adulterant of olive oil. The seeds themselves are eaten in India, Greece, and elsewhere. We import over 25,000 tons of the seeds from India, mostly for oil-crushing. There are two varieties, the white and the greyish-black, the latter being used under the name of *maw-seed* for cage-birds.

Porbeagle, any shark of the genus *Lamna*, with three species, from temperate seas. One, called also the Beaumaris Shark, from the Atlantic, sometimes occurs on the British coasts. It attains a maximum length of ten feet, and, as do the others, feeds chiefly on fish.

Porcelain. This substance, the name of which is derived from the Italian *porcellana* = "a shell," appears to have been completely unknown to the older European nations. It was, however, known to, and manufactured by, the Chinese at a very early period, and about the 16th century large quantities were introduced from China into Europe. It was not, however, until 1709 that its manufacture was performed in Europe, in which year Böttcher, a German chemist, having discovered the method of its preparation, started works at Meissen. For many years the process remained secret, but in 1754 the celebrated potteries at Sèvres were founded, and at intervals other centres of the industry sprang up. The first places in England to carry out the porcelain manufacture were Chelsea and Bow, shortly followed by Derby and Worcester. In composition, porcelain consists chiefly of a very pure clay known as *kaolin*, which is almost pure hydrated silicate of alumina. This substance seems to be derived chiefly from the natural disintegration of the felspar of rocks. It is found largely in China, at Limoges, in Cornwall, and various American localities. It is very infusible, and for the manufacture of porcelain is mixed with a fusible silicate, usually felspar, the proportions of the two substances varying with the different varieties of the product. They are well mixed, and water added until of a sufficient plasticity; the mass is moulded to the required shape, and dried at ordinary temperatures, and baked in a low-temperature kiln. They are then glazed by dipping into water containing felspar in suspension, dried and exposed to a very extreme heat in crucibles in a furnace; after heating, the furnace is very slowly cooled, as otherwise the porcelain would be very unstable and brittle. *Statuary porcelain* is an unglazed porcelain, used chiefly for the production of statuettes, etc., and was introduced in the year 1842, being also frequently known by the name of Parian porcelain or Parian marble. Porcelain takes paint in very much the same way as glass, the pigments being applied and "burnt in" by heating the substance. [GLASS.] The Sèvres porcelain is considered to be the finest example of this branch of art, owing chiefly to the beauty, richness, and depths of the colours.

Porcupine (literally, "the spiny pig"), any individual of the Rodent family *Hystrioidæ*, in

which the skin is set with long, strong spines. They fall into two groups: (1) New World Porcupines, for the most part arboreal, in which the tail is generally prehensile; (2) Old World Porcupines, in which the spines are more fully developed, and the tail is not prehensile. *Hystrix cristata*, the Common Porcupine, occurs in Southern Europe and North Africa. There are some other species. The Brush-tailed Porcupines, with flattened spines at the end of the tail, constitute the genus *Atherura*.

Porifera. [SPONGES.]

Pork, the flesh of swine, is a food in very general use in most parts of the world, except among Jewish and Mohammedan communities. Its great advantages are cheapness of production, since the pig is a prolific animal and a general feeder, and the ease with which it can be preserved without losing its good qualities. The chief prejudices against its use seem to have their ground in the fact that the flesh is rather difficult of digestion when it is fresh; that the flesh is greatly affected by unsanitary feeding; and is in any case to be avoided in hot weather, though a hot climate seems to have little deleterious effect on pork-eaters, since it is a favourite food in the South Sea Islands. To know what pork can be, one has only to eat the flesh of pigs fed on acorns, beech-mast, or dairy-produce, and allowed free grazing and exercise, or to taste a well-smoked wild boar's ham. Ireland and the United States do an immense trade in pork.

Porphyry (233-306), Greek philosopher, whose real name was MALCHUS, was the pupil of Origen and Longinus, and at Rome was a follower of Plotinus. He combated Christianity in a book which has practically perished, but which caused much discussion and provoked many replies. He also wrote a work against the eating of flesh, a life of Plotinus, and a life of Pythagoras. He was not an original thinker, but an echo of Plotinus chiefly. His best-known work is a treatise on *The Five Predicables*, one sentence in which stated the chief problem which the Schoolmen endeavoured to solve.

Porphyry, a term signifying literally "purple," the precise limitations of which, as applied to certain ornamental stones in ancient times, are uncertain. Modern petrographers prefer to use it rather in an adjectival form as applying to any igneous rock in which one or two minerals occur in large distinct crystals, as, for instance, does the orthoclase felspar in the porphyritic granite of Shap Fell.

Porpoise (literally, "the pig-fish"), any species of the Cetacean genus *Phocæna* of the Dolphin family, with two or three species from the Atlantic and Pacific Oceans. There are twenty-five teeth on each side in each jaw; the pectoral limbs are of moderate size and oval in shape; and there is a triangular dorsal fin about the middle of the back. The Common Porpoise (*P. communis*), abundant round the British coasts and frequently entering large rivers, is gregarious in habit, and the gambols of schools may have suggested some of the stories of the "sea-serpent." The average length is

about five feet; and the coloration is dark-grey or black above, and white below, but there is no distinct line between. They feed on fish, and, as they follow the shoals of mackerel, etc., are often taken by the fishermen in their nets. The flesh was formerly eaten; but the commercial value of the porpoise now depends on the oil obtained from its blubber and the leather into which the hide is made.

Porpora, NICOLÒ (1689–1787), Italian composer, whose works were popular in his time, though now mostly forgotten. He was a pupil of Scarlatti, and wrote about fifty operas and much sacred music; but he was especially famous as a teacher of singing, some of his pupils afterwards becoming celebrated.

Porrigio Contagiosa, a form of skin disease which occurs in children, and is characterised by the development of pustules, the secretion from which is supposed to be contagious. This malady is sometimes called *impetigo*; it is usually quickly cured by the use of white precipitate ointment.

Porson, RICHARD (1759–1808), an eminent Greek scholar, was born at East Ruston, in Norfolk, of which parish his father was clerk. The vicar took an interest in his education, and sent him to Eton, whence, through the kindness of another benefactor, he proceeded to Cambridge in 1777. He soon graduated and obtained a fellowship, which lapsed after seven years in consequence of his declining to take holy orders. In 1793 he was made professor of Greek at Cambridge, his salary being £40 a year. In 1794 he published an edition of *Æschylus*, and in 1797 edited the *Hecuba* of Euripides, which were followed by other admirable works. He had no equal as a Greek scholar, and his notes are marvellously erudite and acute; though he himself is said to have been prouder of his calligraphy than of his scholarship. His memory also was prodigious. In 1805 he was appointed librarian to the London Institution at a salary of £200. He neglected his duties and drank heavily, and died suddenly in 1808. He was buried with pomp at Trinity College, Cambridge, his miscellaneous works being collected and published after his death.

Portal Vein. [LIVER.]

Portcullis, an instrument of mediæval fortification, was used to defend the door of a castle, town, or other fastness, against battery from without. In form it somewhat resembled a harrow, and the bottom was provided with spikes. When out of use it rested in a space over the door, and for use it slid down vertical grooves which guided the framework on each side of the doorway.

Port Elizabeth, a seaport and provincial capital of Cape Colony, stands upon the steep coast of Algoa Bay near the mouth of the Zwartkop river. Founded in 1820, it rose to considerable prosperity as the chief emporium of trade with the east coast, and the development of railways added to its importance, though latterly some of the traffic has been diverted to Cape Town

by the opening up of other railway systems. Wool, ostrich feathers, ivory, and diamonds are the staple exports.

Porteous Riots took place in Edinburgh in 1736. They had their origin in the trial of three smugglers who robbed an exciseman. They were condemned to death, and during their presence at the condemned sermon the Sunday before execution, one of them, Wilson, seized the guards and enabled his comrade Robertson to escape. Wilson, who was the innocent cause of Robertson's failing to escape on a previous occasion, was hanged, and his execution was the occasion of a riot, during which Captain Porteous of the City Guard ordered his men to fire upon the mob, some of whom were killed. Porteous was found guilty of murder and condemned to death, but was respited by Queen Caroline. On the 9th September a well-organised body of persons seized him and hanged him. None of the ringleaders were caught, but the Government was alarmed, and at first decreed heavy punishment to the city. This was afterwards reduced to depriving the Lord Provost of future capability of serving and making the city pay £1,500 to the widow of Porteous. Scott has utilised the incident in his *Heart of Midlothian*.

Porter, an English family of which the chief members were JANE (1776–1850), author of *Thaddeus of Warsaw* and *The Scottish Chiefs*, and of *Sir Edward Seaward's Narrative*; ROBERT KER PORTER (1775–1842), a traveller, writer of books of travel, and battle-painter, who was some time British consul in Venezuela, and died at St. Petersburg; and ANNA MARIA PORTER (1780–1832), who wrote numerous romances and collaborated with her elder sister in *Tales Round a Winter's Hearth*.

Porter, DAVID (1780–1843), was born at Boston, Massachusetts. He did good service against the British in the war of 1812–13, and afterwards against West Indian pirates. He entered the American diplomatic service, and died United States minister at Constantinople. His son, DAVID DIXON PORTER (1813–91), entered the American navy in 1829. He distinguished himself during the Civil War as commander of the Mississippi squadron, and while in charge of the North Atlantic squadron assisted in capturing Fort Fisher (January, 1865). He was author of *History of the Navy in the War of the Rebellion* (1887), and several other works.

Porteus, BEILBY (1731–1809), author of the *Summary of Christian Evidences*, was born at York, and educated at Christ's College, Cambridge. He became rector of Lambeth in 1767, master of the Hospital of St. Cross, Winchester, in 1769, Bishop of Chester in 1776, and finally of London in 1787.

Portland. 1. A city and port in Maine, United States, America, situated on Casco Bay, 108 miles N.E. of Boston, with which it is connected by rail. Standing on a peninsula and possessing an excellent harbour, seldom closed by ice, it is an important centre of trade and passenger traffic

between Europe and North America, and also between the neighbouring ports. Founded in 1632, it has developed into a fine city, with broad streets and handsome public buildings. Locomotive-building, sugar-refining, and the tinning of fish and other produce are the chief industries.

2. The chief city of Oregon, United States, America, stands on the W. bank of the Willamette river, 50 miles N. of Salem. Though dating only from 1845, it is now a large and prosperous place owing to its position as the centre of the railway system connecting the surrounding states with the Northern and Union Pacific railroads. Wheat, flour, canned salmon, and lumber are the chief exports; and the imports include most European products required by settlers in the Far West.

Portland, ISLE OF, is actually a peninsula connected with the Dorsetshire coast at a point $4\frac{1}{2}$ miles south of Weymouth by the shingle ridge known as the Chesil Bank. It has an area of 2,890 acres, a length of $4\frac{1}{2}$ miles, and a breadth of $1\frac{3}{4}$ miles. The soil is fertile, and the sheep bred here are noted for mutton; but the beds of oolitic Portland stone are the chief source of prosperity, apart from the business created by the harbour of refuge completed by convict labour in 1872. Two strong forts defend the place, and a castle erected by Henry VIII. still exists. Off Portland Bill flows a strong and dangerous current separating the Shambles Bank from the shore.

Portland Vase, called also the BARBERINI VASE, from the fact of its formerly having been in the Barberini Palace, is a Greek cinerary urn of dark-blue glass with white enamel reliefs. It is ten inches high by seven inches round, and has two handles, and was discovered at Monte del Grano. Sir William Hamilton bought it in 1770, and it came into the possession of the Duchess of Portland, and in 1810 the Duke of Portland lent it to the British Museum, where it is still to be seen. It was broken in 1845 by a madman, but was skilfully repaired.

Port Louis, the capital of the island of Mauritius, is a seaport with a good harbour and commodious quays, situated at the opening of a shallow valley on the N.W. coast. It suffered terribly from the hurricane of 1892, which destroyed a third of the houses.

Porto Rico, one of the Spanish West India Islands, lying 70 miles E. of Hayti, and having an area of 3,530 square miles. Oblong in shape, it is divided by a mountain ridge into two unequal parts, the northern being the larger. The lower grounds yield sugar, coffee, tobacco, cotton, rice, and fruits of all kinds in abundance, and the mountain forests are rich in valuable timber. The capital, St. John's, or San Juan Bautista, is upon a small detached island off the N. coast. Discovered by Columbus in 1493 and occupied in 1511, Porto Rico has been ever since in Spanish hands.

Port Royal. 1. A naval station of Jamaica, stands on the Palisades, a narrow spit that protects the harbour of Kingston. Once the finest town in

the West Indies, it is now a mere collection of workmen's huts; but it contains Admiralty House with its gardens, and well-fitted shops and sheds for the repairing of ships of war.

2. A Cistercian abbey founded in 1204 at Yvette, near Marly, eight miles S.W. of Versailles. Here in 1608 Marie Arnauld, La Mère Angélique, started her conventual reforms; and a few years later a branch was established in Paris, which under the influence of the Abbé de St. Cyran became the headquarters of Jansenism. Port Royal des Champs was then occupied by Antoine le Maître and a few companions; but ultimately the Paris house was suppressed, and nuns only were tolerated at Marly until 1708, when the place was closed and pulled down.

Portsmouth. 1. The chief naval arsenal of England, is a seaport and municipal borough at the extremity of Portsea Island, Hampshire, at a distance of seventy-four miles by L. & S.W. Railway from the metropolis. A narrow channel separates it from Gosport and Haslar to the west, and opens out into the harbour, which extends for nine miles inland. Connected with Portsmouth proper are Portsea to the north, Landport to the north-east, and Southsea to the east. The largest vessels can enter the port at any state of the tide, and there is ample accommodation for the whole British fleet. To the south lies the roadstead of Spithead, protected by the Isle of Wight. The docks cover 290 acres, and have every requisite for building, fitting, and repairing ironclads of the largest size. The town received its first charter from Richard I., and became a naval station of importance in the 13th century, but its present development can be traced back only to 1544. In addition to handsome modern public buildings, there are the church of St. Thomas (12th century), and parts of St. Nicholas' Hospital (13th century), now the garrison chapel.

2. A city and port of Rockingham county, New Hampshire, United States, America, lies at the mouth of the Piscataqua, 57 miles north-east of Boston. It was first settled in 1623, and is in much repute as a summer resort. Though the harbour is excellent, there is little trade, and the United States navy yard is on the other side of the river in the state of Maine. It shares with Concord the rank of sessions town for New Hampshire.

3. The capital of Scioto county, Ohio, United States, America, is a rising city, owing to its position at the southern terminus of the Ohio and Erie Canal, and its connection by rail with the mineral and agricultural regions of the states of Ohio and Kentucky. It has iron-smelting works, foundries, rolling-mills, saw-mills, etc., and, though founded only in 1803, has had a charter since 1814.

4. The capital of Norfolk county, Virginia, United States, America, is one of the best harbours on the Atlantic coast, being situated on the W. bank of Elizabeth river, opposite Norfolk. The Gosport navy yard, with its large dry dock and hospital, is established here. There is a considerable export trade in cotton, timber, pig-iron, and agricultural produce.

Portugal, the most westerly kingdom of Europe, and *geographically* a province of the Iberian peninsula, is bounded on the north and east by Spain, on the south and west by the Atlantic. Lying between lat. $36^{\circ} 56'$ and $42^{\circ} 10'$ N., and long. $6^{\circ} 15'$ and $9^{\circ} 30'$ W., it is 362 miles in length and 140 in breadth, and contains about 34,500 square miles, not reckoning the Azores and Madeira. The chief towns are Lisbon, the capital, situate at the mouth of the Tagus, and Oporto, at the mouth of the Douro. The Douro and the Tagus, like the Guadiana, the only other important river, rise in Spain. The mountain systems, too, are western or south-western extensions of Spanish ranges. The climate is singularly temperate and equable, the mean average temperature at Oporto and at Coimbra in January showing a variation of only twenty degrees from that of July. There are many valuable medicinal springs, and there is no dearth of minerals. Of the surface, about 3 per cent. is occupied by extensive forests of oak, chestnut, sea-pine, and cork, 24 per cent. is grass-land, $15\frac{1}{2}$ per cent. is arable, and $4\frac{1}{2}$ per cent. is devoted to olive-groves and vineyards in about equal proportions. In the lowlands the chief products are rice, olives, oranges, lemons, citrons, figs, and almonds; in the highlands, wheat, barley, oats, maize, hemp, flax, and the vine.

But in agriculture, as in mining and manufactures, Portugal is in a lamentably backward state, as is indicated by the fact that her *imports*, which in 1891 were of the value of £11,115,333, include wheat, coal, hardware, machinery, cotton, and woollen stuffs, in addition to sugar and dried stuffs. The *exports* in the same year amounted only to £7,082,666, and more than half of the total value is represented by wine, the production of which, with the cultivation of the olive, is the chief industry of the country. The imports from the United Kingdom (and the Colonies) in 1892 were of the value of £2,509,574; the exports amounted to £3,632,643. The commercial marine consists of 36 steamers and 433 sailing vessels, with a total tonnage of about 110,000; the *navy* of 55 more or less seaworthy vessels—39 steamers and 16 sailing craft, carrying, or capable of carrying, 4,124 sailors. The *army* in 1892 numbered 40,000 men on a peace, and 125,057 on a war, footing, with 264 guns. Not more than about 1,000 miles of railways are open. For many years the public *revenue* of Portugal has been considerably below the expenditure. The national debt, consolidated in 1891, is as much as £137,224,000, with a floating debt of £5,113,691. At the beginning of this year (1891) the king relinquished one-fifth of the amount of his civil list of £144,000, but in spite of this and other rigorous economies, the estimated revenue for 1893-94 is more than £1,100,000 below the expenditure.

The present system of *government*, hereditary and constitutional, dates from 1826, though it was modified in 1852, 1878, and 1885. A Cabinet of seven members is chosen by a Prime Minister nominated by the king. The House of Deputies consists of 180 paid members (168 for the continent, the Azores, and Madeira, and 12 for the

colonies), elected for four years by the votes of all adult male citizens who have an annual income of 100 milreis (about £22); but priests, officers, graduates, and certified teachers are voters *ex-officio*. The House of Peers numbers 52 hereditary members, 13 prelates, 139 life members nominated by the king, and 50 chosen by indirect election. The Roman Catholic is the established *religion*, but the power of the Church was broken when, in 1834, the monasteries were dissolved and their possessions appropriated by the State, and the priests have no control over education, which in theory is compulsory.

History. Portugal, the Lusitania of the Romans, may be said to have begun its career as a nation about the end of the eleventh century. In 1094 Alfonso VI. of Castile conferred it upon Henry of Burgundy as a dependent fief, its then limits being from the Tagus to the Minho. By Henry's son, Alfonso I., it was elevated into an independent kingdom. The house of Burgundy occupied the throne until 1578, and it was under their rule that Portugal rose to be the chief maritime power in Europe and acquired its very extensive colonies. With the extinction of the Burgundian dynasty an era of decadence began which does not seem yet to have reached its term. Rival claimants for the throne appeared, and in 1580 Portugal was incorporated with Spain. A War of Independence began in 1640 under the Duke of Braganza, who was crowned as John IV., and in 1668, partly owing to English aid, the work of liberation was consummated; but by this time many of the colonies were for ever lost, and the nation had suffered grievously in blood and treasure as well as in *morale*. The chief events in the modern history of Portugal are those connected with the Peninsular War and the loss of Brazil, which became independent in 1822. At the close of the Peninsular War Portugal adopted a constitution modelled upon that of England. It was in the war waged on behalf of Pedro IV. against Miguel, who had violated his oath and played the despot, that the Portuguese fleet was practically destroyed off Cape St. Vincent. The ambition of Portugal to take part in the colonisation of Africa received a serious check in 1889, when she was forced by Lord Salisbury to abandon her claims to Nyassaland.

Ethnology. The Lusitani, the earliest known inhabitants of Portugal, appear to have been a mixed Ibero-Keltic people, who later became further modified by Italian settlers during the empire, by Teutons (Visigoths and Swabians) at the time of the northern migrations, and south of the Tagus by the Moors (Arabised Berbers), who remained masters of Algarve till the middle of the 13th century. A strain of black blood has even been introduced, partly from Africa during the 16th century (when from 10,000 to 12,000 slaves were annually imported), partly from Brazil, whence numerous half-castes have arrived during the present century. But all these mixtures, to which must be added many tens of thousands of Galicians in recent times, have not resulted in a fine race; for the majority of the inhabitants are a small, somewhat weedy people, with irregular features

and lack of expression. In some districts, however, the women are noted for their light complexion, bright eyes, vivacity, and graceful carriage. They are courteous, friendly, and considerate towards each other, less cruel than their Spanish neighbours, but perhaps more superstitious and more prejudiced against foreigners. Despite the prevailing ignorance, the majority even of the peasantry express themselves with remarkable ease and correctness in the national language, which is a distinct member of the Romance (Neo-Latin) family, differing greatly from Spanish, highly expressive and idiomatic, and noted especially for its contracted forms and nasal utterance. The literature boasts of numerous elegant, if not original, writers in prose and verse, including at least one great name—Camoëns, author of the *Lusiad*.

Portuguese Man-of-War, the common name of *Physalia*. [PHYSOPHORIDÆ.]

Port Wine, a Portuguese wine which takes its name from Oporto, since the district in which it is produced consists of a mountainous region along the Douro, extending 12 miles inland, and beginning a few miles above Oporto, with which it is connected by railway. Its natural colour varies from pale rose to deep red, though it is often coloured artificially, and is much fortified with brandy for the English market, thus becoming a very different wine from what one finds it abroad. The special qualities of this wine are the outcome of the soil and climate. After the autumn vintage the wine is kept in vats till spring, and is then transferred in casks to Oporto, where it is fortified. The brandy departs with age, and the wine then becomes of a tawny colour. In the 16th century it became known in England, and an English factory was founded in Portugal, and obtained such a monopoly that the Marquis of Pombal in 1756 made a successful effort to break it down. The Peninsular War doubtless contributed to making port popular in England.

Posen, a province of Prussia and its capital. The former is bounded N. by Prussia, E. by Russian Poland, S. by Silesia, and W. by Brandenburg, and has an area of 11,180 square miles. Some portions are very fertile, producing wheat and other cereals, potatoes, hops, tobacco, and even wine, whilst the wild pastures feed many cattle and sheep. The rivers Netze, Warthe, and Obra drain into the Oder, and the Vistula bounds the N.E. frontier. Originally a district of Poland, it was acquired by Prussia in 1772 and 1793, and the treaty of 1815 confirmed the annexation. Posen, the capital, stands at the junction of the Cybina and the Warthe, and is strongly fortified. Its foundation dates back to the 10th century. It is the seat of a Roman Catholic archbishopric, and the cathedral contains several curious specimens of ancient art. Agriculture is the chief source of prosperity.

Posilipo or PAUSILIPO, a mountain which projects into the sea on the W. of Naples opposite the island of Nisida. It is pierced by the tunnel called the "Grotto of Posilipo," which is 2,316 feet long, 22 feet broad, and 89 feet high, and affords

passage to the road between Naples and Pozzuoli. Near the entrance is the so-called tomb of Virgil.

Positivism. [POSITIVISTS.]

Positivists, the followers—not very numerous in France, and less so in England—of the philosophical principles enunciated by Auguste Comte, whose *Cours de Philosophie Positive* was published 1830–42. He was comparatively little known in England till G. H. Lewes, in 1846, in his *History of Philosophy*, declared his adherence to the views of Comte, whom he called the "Bacon of the 19th century." Comte's view of metaphysics was that they were only a stage, and that a faulty one, in the development of human thought. He held that there were three stages in this development: (1) a "theological" stage, in which all phenomena were looked on as the results of the intervention of supernatural agents; (2) the metaphysical, in which they were referred to abstract powers as a cause; and (3) the positive, or scientific stage, in which nothing was looked for beneath uniformity of nature and a universal orderly succession of phenomena. Knowledge he divides into inorganic physics and organic physics. Inorganic physics he subdivides into celestial and terrestrial, the latter further subdividing into mechanics and kindred branches on the one hand, and chemistry on the other; while organic physics includes biology and a new science of sociology, which looks on the individual as a kind of cell or monad in an organic whole, called humanity. All these sciences imply mathematics as a pre-condition, and so the chief divisions fall into a progressive scale, each division implying all the preceding, but taking up a new set of phenomena. The scale is at once a classification of the sciences and the order (on the whole) of their historical development, and is to be their order in education—viz. mathematics, astronomy, physics, chemistry, biology, sociology. Humanity, to whose service all knowledge is to be devoted, is the one supreme being, for the worship of which Comte established a religion and a new calendar of saints or benefactors of the human race, to whose commemoration different days were to be dedicated. Among his English critics are Harriet Martineau, Congreve, his chief English disciple and translator, Herbert Spencer, John Stuart Mill, and Professor Huxley. Neither of the last three accepts his dogmas, though Mill found something attractive in the idea of a religion of humanity; as also did George Eliot, who, no doubt, was much influenced by G. H. Lewes. The English Positivist school, however, of which the best-known members are Mr. F. Harrison, Mr. Beesly, and Dr. Congreve, has influenced English political thought considerably. Many include, under the term Positivist, Spencer, Bain, and all who direct scientific attention solely to phenomena and their sequences; but the Positivism of this school of thinkers is not identical with that of Comte, though they, with him, eschew metaphysics as fiction.

Post-mortem Examination. An examination of the body of a dead person is sometimes made, with the consent of the relatives or friends, with a view to establishing the diagnosis of the

disease which has caused death, in instances where the symptoms during life have been obscure. Where there has been no medical attendance during life, or where there is any suspicion of foul play, the coroner may order a post-mortem to be made.

Post Office. The establishment of "posts" dates from the reign of Henry VIII., but it was not until 1635 that the actual history of the Post Office can be said to have commenced. Until that date the system of posts was hardly used for any other purpose than the conveyance of Government dispatches. The Master of the Posts was a Court official, and, although in certain exceptional cases private letters were forwarded by post, there was no need for a public office in London. At the end of the 16th century a foreign post, used mainly by the foreign merchants of London, was instituted, and it was then that a Post Office in London first became necessary. It is believed to have been situated in Cloak Lane, near Dowgate Hill; but, although an organised system was first introduced at this date, it had very little relation to the service of the present day, which, in its turn, practically dates from the establishment of penny postage by Sir Rowland Hill in 1840. Previous to that date the Post Office existed almost solely for the purpose of the delivery and the collection of letters, and, in the absence of anything like uniformity in charges, the varieties and complications were most bewildering.

As late as 1808 the charges for inland letters were at the following rates:—A single letter going 15 miles, 4d.; 30 miles, 5d.; 50 miles, 6d.; 80 miles, 7d.; 120 miles, 8d.; 170 miles, 9d.; 230 miles, 10d.; 300 miles, 11d.; 400 miles, 1s.; and so on in proportion, one penny for each hundred miles. In 1695 the postage from London to Liverpool, or to York, or to Plymouth was, for a single letter, 3d., but in 1813 it was 11d.

With the introduction, however, of a uniform rate of postage, and with the discovery of the steam-engine, and of the telegraph, the work of the Post Office began to assume very large dimensions, and the department was not long in adapting itself to the increased demands of the nation. At the present day the collection and delivery of letters is not the only, and can scarcely be called the chief, work of the Post Office.

The Money Order system was incorporated with the Post Office in 1838; the Savings Bank Department was started in 1861; Life Insurance and Annuity business was undertaken in 1865; the telegraph wires of all the private companies were purchased in 1870; Postal Orders were first brought into operation in 1881; the Parcel Post was instituted in 1884; and the latest introduction to the work of the department is the development of a telephone service which is being rapidly extended throughout the country. In order to carry on this enormous business the Post Office employed for the year ending March 31st, 1893, 131,459 persons of all classes. The gross revenue for the same period was £11,698,819, and the net revenue was £10,344,353. The number of post offices in the United Kingdom at the close of the same

period was 19,625. For the year ending March 31st, 1893, 1,790,500,000 letters were delivered in the United Kingdom, the average number for each person being 46·6. To show the increase which has taken place in even so short a period as seven years, it is sufficient to state that the letters delivered for the year ending March 31st, 1886, amounted to 1,403,547,900, the average number for each person being 38·6. Post-cards, book-packets, circulars, and newspapers, are not included in these figures.

The Money Order business, together with the postal orders issued by the department, shows a similar increase. The number of postal orders issued in the United Kingdom for the year ending March 31st, 1893, was 56,590,668, or 3,931,123 more than in the previous year. The value represented by the orders was £21,345,153, or £781,403 more than the value of those issued in 1891-92. These figures sufficiently demonstrate the boon which the Postal Order system is to the people of this country.

But perhaps the most remarkable branch of the department from the point of view of the public convenience is the Post Office Savings Bank, which, since its establishment in 1861, has increased by leaps and bounds every year. The latest Postmaster-General's report attributes the great increase in the business which took place in 1892 to "the lamentable frauds and failures in connection with so many investment societies which have directed public attention more than ever to the unquestionable security of the Post Office Savings Bank." The amount (including interest) which remained to the credit of the depositors on 31st December, 1892, was £75,853,079, being £4,245,077 more than at the close of the previous year. The greatest number of deposits on any one day was 71,634 on the 31st January. The total number of depositors on the 31st December, 1892, was 5,452,316, and the way in which this total is made up is rather interesting. For instance, England and Wales contribute no less than 5,027,431 to the number, or 1 in 6 to the total population, and £13 18s. is the average balance due to each depositor. Scotland contributes only 199,062, or 1 in 20 to the total population, and the average balance is £8 17s. 9d. In Scotland, however, the Post Office Savings Bank has to encounter rivalry with private enterprises which offer greater conveniences than similar institutions do in England and Wales. Ireland contributes 225,823 to the total, or 1 in 20 to the whole population, and the average balance is £18 12s. 11d.

Since depositors were enabled to invest in Government Stock through the medium of the Post Office Savings Bank, no less a sum than £5,599,020 has been applied in this way. One of the special facilities which the Post Office offers to investors or depositors is the right to use the same deposit book at any Post Office Savings Bank. Of the aggregate number of deposits and withdrawals last year nearly 32 per cent. were effected at offices other than those at which the accounts were opened, while, if the withdrawals are taken alone, the percentage is more than 43. By an Act of Parliament passed so recently as December, 1893,

the annual limit of ordinary deposits has been raised from £30 to £50. The annual limit for investments in Government Stock has been raised from £100 to £200, and the total limit has been raised from £300 to £500. In a little more than two months after the passing of the Act, 29,000 depositors availed themselves of the increased limit, and, as compared with the corresponding period last year, the total amount deposited showed no less an increase than £1,017,840.

The Telegraph branch of the service, which since 1870 has become a monopoly of the Government, is still carried on at a loss, the deficiency for the year ending March 31st, 1893, taking into account interest and capital expenditure, being £454,254. The total number of telegrams of all kinds—ordinary, press, foreign, railway, and Government—for the same period was 69,907,848. By the Telegraph Act, 1892, a loan of a million sterling was authorised for the purchase of the trunk-lines of the telephone companies and for the construction of a Government system to connect the business centres of the kingdom. Trunk-lines are being constructed between Leeds and Hull, London and Brighton, Swansea and Cardiff, Cardiff and Newport, Newcastle and Hexham and Morpeth. A trunk-line between Glasgow and Belfast has already been opened, and for some time past it has been possible for the Parisian in Paris to carry on a conversation with the Londoner in London. It has been said that "it is a somewhat humiliating thought to a zealous servant of the Post Office that the institution of which he is so proud would in all probability never have existed had not our forefathers been anxious to read the letters of other people." Indeed, apart from this motive there is obviously no reason why the State should undertake the carriage of letters more than of any other commodities. Moreover, this singular monopoly has survived throughout Europe the conditions which first gave it birth. The monopoly in this country has very frequently had to fight for its existence, and to apply to Parliament to be protected against the efforts of private enterprise.

When telegraphy had passed out of the stage of experiment, it was seen that it could be best utilised by the community if under the care and regulation of the State; while, of course, the fittest State officer to preside over the growth was the officer charged with the carriage of communications by letter. The monopoly of transmitting telegrams was therefore conferred upon the Postmaster-General.

The Parcel Post return for the year 1892-93 shows the total number of parcels conveyed to have been 52,370,326, as against 22,910,040 in the year 1884-85.

The Postal Union was established on the 1st of July, 1875, as a result of the Postal Congress held at Berne in 1874, and a treaty was signed by most of the European Powers and by the United States. A Postal Congress, to discuss points and to consider propositions affecting the Union, assembles once every five years, at which delegates from all the States concerned meet. The last International Postal Congress was held at Vienna, May 20, 1891.

The head of the English Post Office is the Postmaster-General for the time being. He represents the department in Parliament, and his term of office is dependent on the life of the particular Ministry of which he is a member. The permanent heads of the Post Office are the secretary, the financial and assistant secretaries. Besides these officials, each department and branch has its own permanent chief, who is largely responsible for the work and discipline of his own office.

The head office is at St. Martin's-le-Grand, where two immense buildings are quite insufficient to house the army of officials who are stationed at head-quarters. A third building has just been added; but, even with this in working order, the Savings Bank department has to find a home in Queen Victoria Street, and the Money Order office is in temporary premises at Coldbath Fields.

Post-Pliocene. [PLEISTOCENE.]

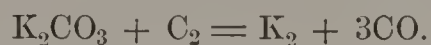
Post-Tertiary. [PLEISTOCENE.]

Potash. Potash, or caustic potash, consists chemically of potassium hydroxide, KOH, and may be regarded as derived from water by the replacement of one-half of the hydrogen in the latter by potassium. It is formed when this element acts upon water, and is usually prepared by boiling a solution of potassium carbonate with slaked lime, the solution being evaporated down in silver basins and cast in sticks. If required pure, it is recrystallised from hot alcohol. It is a very powerful alkali, and absorbs carbonic acid and water very readily. It is a powerful caustic, acting strongly on organic matter. It is an invaluable reagent in the chemical laboratory, and is employed in pharmacy and in very many chemical industries.

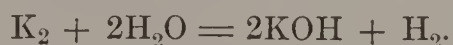
Potashes. This term is applied to the carbonate of potash which was formerly obtained by lixiviation of the ashes obtained from burnt vegetable matter. It is still obtained from this source in localities where wood is cheap. It is so formed owing to its occurrence in almost all vegetation, which derives the supply from the soil. On this account potash salts are a necessity in soils, and, if the natural supply is insufficient or becomes exhausted, it has to be increased by the addition of potash manures. Other sources of potassium carbonate have now almost entirely supplanted the former potashes, or *pearl ash*, as the crude product was then called, the greater portion being obtained by chemical means from the potash salts which occur so plentifully in the salt beds of Stassfurt and Galicia. It is extensively employed in glass-making, soap manufacture, in the chemical laboratory, and a number of chemical industries.

Potassium (K = 39). Although the compounds of this metallic element are widely distributed and plentiful, it was not itself prepared until the year 1807, when Sir Humphry Davy obtained it by the decomposition of the fused potassium hydrate (potash) by means of an electric current. It occurs in nature largely as silicates in various rocks and minerals, as felspar, mica, etc. It is a constituent of all plants, combined with

organic acids, and remains in the ash when the plants are burnt. [POTASHES.] In sea-water it occurs to a considerable extent, and vast beds of potassium salts occur at Stassfurt. Deposits of nitrate of potash, or *nitre*, occur also as an efflorescence on the soil in certain tropical localities—*e.g.* Chili, etc. The metal is prepared by heating strongly a mixture of the carbonate and carbon; it is then produced in accordance with the equation



The ignition is effected in iron cylinders, the potassium which distils over being condensed in flattened iron receivers, but the manufacture is attended with considerable danger. The element is a white metal with a violet tinge, and very soft. It possesses a specific gravity of about .86. It hence floats on water, which it decomposes with the liberation of hydrogen, which the temperature is high enough to ignite. Owing to this, it immediately tarnishes in moist air, and has to be kept under naphtha or liquid hydrocarbon. By this action of water potash is formed—



It melts at 62°, and yields a green vapour at higher temperatures. It appears to form three oxides of composition K_2O , K_2O_4 , and K_4O . Many of the salts of potassium are substances of great importance. The hydrate KOH is known as potash (q.v.), and the *carbonate* first came into commerce as *potashes*. The chloride KCl is an important salt—white, crystalline, and readily soluble in water—which is chiefly obtained from the Stassfurt beds. The *ehlorate* $KClO_3$ is very largely used in pyrotechny, forming with sulphur or charcoal very explosive mixtures. It is hence dangerous to use except by those fully conversant with its properties. In medicine and pure chemistry chlorate of potash also finds use, while it is largely used in the manufacture of lucifer-matches. Potassium *bromide* and *iodide* are both valuable medicines, the former in nervous diseases and the latter in skin diseases and many other cases. The *sulphate* K_2SO_4 has been long known, and is employed in the preparation of alums and medicinally as a purgative. The *chromate* and *bichromate*, K_2CrO_4 and $K_2Cr_2O_7$, are respectively yellow and red salts, used extensively in the laboratory, in dyeing, calico-printing, in the manufacture of pigments, and in certain processes in photography. The *cyanide* KCN is a white, highly-poisonous salt used very largely in photography, electroplating, and in chemical operations. A mixture of various sulphides is used in pharmacy under the name of *liver of sulphur*. Probably the most important of its compounds, however, is the *nitrate* KNO_3 , which finds innumerable applications under the names of *nitre* and *saltpetre*. [NITRE.]

Potato, a corruption of the name *Batatas*, referring originally to the Spanish or Sweet Potato (*Batatas edulis*), a member of the Convolvulus family, but now far more generally used for *Solanum tuberosum*, the most valuable species of the Nightshade family. It occurs wild in various parts of South America, and is believed to have been brought to Europe by the Spaniards

early in the 16th century, though Raleigh's colonists only brought it from Virginia to Ireland in 1586, and it did not reach Scotland till 1725. Its coarse leaves are lyrate and interruptedly pinnate (q.v.), and it has a large handsome flower, either pale lavender or white, which is succeeded by a nuculane. The tubers vary in size, shape, and colour; but exhibit their stem character in the buds or "eyes" they bear. The plant is commonly propagated by cuttings of these tubers. Potatoes are about 75 per cent. water, and the rest very largely starch, so that they are by no means highly nutritive. In cultivation the plant has become very subject to the attacks of the parasitic mould *Phytophthora infestans*, now generally known as "the potato-disease," which discolours the leaves and spreads down into the tubers. In the hope of obviating this, other species have been experimentally introduced from the moister regions of the Andes, notably *S. Maglia*, or Darwin's Potato. There are $1\frac{1}{3}$ million acres under potatoes in the United Kingdom, producing nearly $6\frac{1}{2}$ million tons annually, besides which we import several million cwts. In addition to their use as a vegetable, potatoes yield much starch for other purposes. It is mixed with flour in bread-making; from it "British arrowroot" and other food substances are prepared; and large quantities are converted into *dextrin* or British gum, which is used for postage-stamps, envelopes, etc. Much of the "silent spirit" or unflavoured alcohol manufactured on the Continent is prepared from potatoes.

Potemkin, GREGORY ALEXANDROVITCH (1739–91), one of the chief favourites of Catherine II. of Russia, was born in Russia, but came of a noble Polish family. In 1762 he attracted the attention of the Tsarina, after which his rise in favour and station was rapid. For thirteen years he directed the foreign policy of Russia, obtained the annexation of the Crimea in 1783, and was commander-in-chief in the Turkish War which began in 1788, though its successes were probably chiefly due to the ability of Suvarof, who served under him.

Potential is a mathematical function first used by Laplace in his investigations on gravitation. Green, however, who gave it the name, was the first to work out a theory of potential, his theorems embodying the fundamental properties of the function and remaining undiminished in importance at the present day. The function is of special value in the consideration of conservative systems. A conservative system consists of any definite number of bodies whose mutual forces do the same amount of work in changing from one position to another, whatever be the route followed. Thus (disregarding friction, which cannot belong to a conservative system), the same amount of work will be required to lift a body vertically ten feet as to carry it up a flight of steps to the same level. The earth and the body are, in fact, a simple example of a conservative system. It is a property of matter that every particle of it attracts every other particle with a force whose direction is that of the line joining the two particles, and whose magnitude is

proportional to the product of the masses of the particles divided by the square of the distance between them. This property also belongs to magnetism and electricity. In these cases the force between the given bodies depends only on the distance, and the question of their velocities is not considered. This determines that the system shall be a conservative one, and therefore that the theory of potential applies to it. The potential energy of a conservative system in any particular configuration is the amount of work which must be done upon it to bring it from some standard configuration to the one in question. If we are dealing with two bodies between which any attractive or repulsive force is acting, the standard position is taken to be that in which they are infinitely far apart. In the case of gravitation work would be done *by* the bodies in being brought near to each other from their far-off positions, hence the amount of work done *upon* them would be negative—*i.e.* their mutual potential energy would be negative. When electrical or magnetic repulsion is the active force, the mutual potential energy will be positive; thus two north poles of a magnet will have a positive mutual potential energy. The potential *at* any point is considered to be the mutual potential energy between a unit mass placed at the point and the body causing such potential. Thus the potential at a point 4 feet away from a mass of 2 lbs. is the mutual potential of two masses of 2 lbs. and 1 lb. respectively 4 feet apart, and is the amount of work which must be done to bring the 1 lb. from infinity to the point in question. It is convenient in this case to change the sign, and so to regard the potential as positive. Let V_A be the potential at A due to any body some distance off, and let V_B be the potential at B due to the same body. $V_A - V_B$ is then the difference of potential between A and B, and is the work which must be done to take a unit mass from A to B, whether the mass be moved along A B or any other path A C B. If the attracting body be far from A and B, we can consider the forces between the body and unit mass at A and at B to be parallel. This force can be resolved into a component, P, along A B, and a component, Q, perpendicular to it. To move unit mass from A to B requires an amount of work, $P \times A B$. But we saw that $V_A - V_B$ was also equal to this amount of work. Therefore—

$$P \times A B = V_A - V_B, \text{ or } P = \frac{V_A - V_B}{A B}.$$

Hence in this case the force in the direction A B is equal to the rate of change of potential per unit length, and as the attracting body is very far off, A B may be *any* direction. The theory of potential is embellished with elaborate mathematical expressions which find their chief application in electrical and magnetic investigations. Nature, however, never gives us an example of a perfect conservative system. Invariably we find that either friction, resistance of the air, resistance due to electric induction, or some other form of resistance, steps in to destroy the simplicity of what might appear to be a conservative system, and causes in it an inevitable loss of energy.

Potentilla, a considerable genus of herbs and shrubs, including about a dozen British species and belonging to the order Rosaceæ. Their leaves may be ternate, quinate, or pinnate, and are sometimes silvery on one or both surfaces. The five-leaved calyx has an epicalyx (q.v.) immediately below it, and the petals are generally five and yellow, but may be four and white, orange or crimson. The quinate forms are called "cinque-foils." They are closely related to the strawberries—some species producing "runners"—but the fruit is a dry *etærio* (q.v.) of achenes.

Potomac, a river of the United States, rising from two sources in the Alleghany and the Shenandoah Mountains respectively. Flowing S.E., it separates Maryland from Virginia, is joined by several affluents from those states and from Pennsylvania, the largest of these being the Shenandoah. An estuary opening into Chesapeake Bay forms the mouth of the river, the entire length of which is about 400 miles. Washington stands on its banks, about 125 miles from the sea, and to that point vessels can ascend.

Potosi. [SAN LUIS DE POTOSI.]

Potosi, the chief town of the department of Potosi, Bolivia, is situated on a bleak plateau, 13,250 feet above sea-level, under the peak of Cerro de Potosi, and near the sources of the Pilcomayo. Silver was first discovered here in 1545, and the town was founded soon after. The province of Potosi has an area of over 30,000 square miles, but is mountainous and barren.

Potsdam, the chief town of the province of Brandenburg, Prussia, lies 16 miles S.W. of Berlin on the river Havel, here broken into many small lakes. It is the suburban residence of the Imperial Court. The surrounding scenery is pretty, and the various parks are laid out with much taste. The Royal Palace, the park of Sans Souci, with the palace of the same name, the New Palace, the Pompeian Charlottenhoff, the Orangery, and the great drill ground with barracks and military school, and the Marble Palace are the chief places of interest. The town itself is well kept, and has broad streets and fine houses.

Pottawatomies, North American Indians, a branch of the Algonquian family, whose hunting-grounds formerly extended round the southern shores of Lake Michigan chiefly in the present states of Illinois and Wisconsin. At a great gathering of the nation in 1833 at Fort Dearborn, where now stands Chicago, about 20,000,000 acres of their domain were ceded to the United States, and since then all, except a small band in Wisconsin, have been confined to various reservations, such as the Sac and Fox Agency, Indian Territory, Pottawatomie Agency, Kansas, and Walpole Island, Ontario.

Potter, JOHN (1674–1747), Archbishop of Canterbury, was the son of a Wakefield draper. He was educated at Oxford, and in 1697–99 published *Archæologia Græca*, for some time a very popular work. In 1708 he became Regius

Professor of Divinity, and seven years later Bishop of Oxford, being appointed Primate ten years before his death. He took part against Hoadley in the Bangorian Controversy.

Potter, PAUL (1625-54), the great Dutch animal-painter, was born at Enkhuizen, his father being a landscape-painter. He lived chiefly at Amsterdam and The Hague, and died before he was thirty at the former city. His most celebrated picture is the life-size *Young Bull* now at The Hague; most of his other works are very small.

Pottery. The word "pottery" is derived through the French *poterie* from the Latin *poterium*, a cup or drinking vessel. This, originally

history of our civilisation that man found that fire had the effect of hardening the crumbling clay, and from that time the potter's work was fired, and his art became a permanent record of civilisation. For many centuries in every country these simply-baked pots were all that were known, and various expedients were used to prevent the loss of the liquid, by reason of their porosity, they were required to hold; and coatings of wax or pitch were applied to their internal surfaces to render them more or less watertight. This was done to those vessels of the Greeks and Romans that were destined to contain water or wine or oil, and, indeed, is used to this day in many Mediterranean countries.

Certain finer wares were, however, exceptions to



POTTERY.

Fig. 1.—A, Vase from Cyprus, illustrating unglazed ware; B, Damascus plate, siliceous glaze on a white ground; C, Chinese bottle, porcelain, feldspar glaze.

of clay of the simplest form, came to stand for all kinds of vessels made of earthenware. The potter's art is perhaps the oldest in the world. The wonderful series of monuments in Egypt allow of a more or less accurate history of many arts to be written; and from this source it is certain that from 3000 B.C. jars for milk and wine, and pans and bowls for domestic use, were in common use in that country. As to how long before this date, and how far back into prehistoric times, pottery was made, it is impossible, in the present state of our knowledge, to make any useful guess. The earliest potter's vessel was made of clay, roughly moulded or modelled into its shape, whether globular or elongated, by the hand of the worker, which, guided by his eye, served to make some very symmetrical vases, such as are now found in the tumuli of the early inhabitants of this country. At first these were simply sun-dried or air-dried, and were naturally very friable and useless for service as containers of anything but corn, seeds, or similar substances. It was, however, very early in the

this rule. They were more or less impervious from the fineness and closeness of the texture of which they were made, rather than from the application of a glaze such as we are accustomed to see. Nevertheless, true glass glazes and true enamels were known in Egypt and Assyria in very early times, and doubtless the necessity for rendering the ordinary baked vessel capable of holding liquids led to the early application of either glaze or enamel to the ware to bring about this end. The early Greek and Etruscan pottery show not only a rudimentary glaze, but, what is more interesting, show that by the application of outlines and painting to their vases—by which they have transmitted to us a storehouse of facts, traditions, myths, and folklore—they have produced vessels that are now valued as the highest efforts of the potter's art.

The invention of the potter's wheel or lathe, laid horizontally and revolving on a central axis and pivot, on which the clay was "thrown," and to which it adhered sufficiently firmly to allow it to

be accurately shaped, was a wonderful advance; for, as the wheel spun round, all possible combinations of spherical and cylindrical forms, of even thickness and of perfect symmetry, could be produced with great speed. It is remarkable that no instance of Greek work has been found that has not been "thrown" on the wheel or moulded, though this latter method of production is only found on the latest wares.

Pottery may be divided into certain large sections, such as glazed and unglazed. The unglazed ware



Fig. 2.—HISPANO-MOORISH PLATE, LUSTRE ON THE ENAMEL.

(Fig. 1, A) may be of hard or soft body. A soft body is one that can be scratched with a knife. The glazed wares, again, can be divided into those which are glazed with glass glaze, with lead glaze, or with salt glaze. A further subdivision may be made of those wares which are coated with enamel.

The ordinary potter's vessel is made of any suitable clay, and, after being fired in a kiln to render it capable of being handled and to render it hard and compact, it is dipped into a mixture of powdered glass and water (the constituents of which are siliceous sand and soda) and fired again to fuse this opaque-looking powder into a clear transparent skin or glaze. It is obvious that the original colour of the baked clay is seen through this glassy coating. The addition of lead to this powdered glaze and water gave a material that was more easily fused and not less transparent, but from this cause it still allowed the colour of the body of the pot to show through its clear substance. The opportunity to use colour was slight, and efforts were made to find a surface suitable to take simple colours. A very obvious means to obtain this was to coat the common body with a layer of white clay, such as pipe-clay, and, after firing, paint on this as on plaster or paper, and then glaze on it over the coloured pattern upon its surface. After firing, this pattern became embedded in the glaze of the surface of the pot.

Working in the same direction, it was found that the addition of the oxide of tin gave to the glaze a perfectly smooth, flowing, glossy, but opaque white surface, which covered all the roughnesses and inequalities of the body, whether of colour or

texture. It was further found that various metallic colours could be applied to this surface before firing, which became embedded into it after the whole had been fused in the kiln. This method of treating ware prevailed from the 15th century without interruption until the introduction of porcelain from China drove it out of use, the newer material having a far finer surface on a far harder and whiter body.

Another method of glazing ware, which was also without doubt discovered many centuries before pottery was wanted for anything but the most strictly utilitarian uses, was that of salt-glazing. The material to which this method is applied must be of extremely hard body, as it is necessary that it shall be at a white heat before the salt is applied. This substance is thrown into the kiln on to and among the pieces of ware, and is decomposed by the intense heat. Its soda is volatilised, and seizes on the surface of the ware (in which a certain amount of flinty clay is present), and combines with the ware itself in the form of pure flint-soda glass, absolutely adherent as a portion of the pot is dissolved to make it. Of this ware the most recent development is that known as Doulton ware, and before modern times a very artistic ware made on the Rhine known as Grès de Flandres, or Steingut of the Germans. It is called stoneware by all English writers (Fig. 3).

As regards the other methods, that described as tin enamel is characteristic of the wares of Italy, Spain, and Sicily since the beginning of the 15th century, and is perhaps the most artistic pottery ever produced. It had in Italy the services of designers of the first rank, and is sometimes called Raphael ware from a doubtful tradition that that great painter designed for the master-potters of this ware. It is also the covering of the beautiful Hispano-Moorish wares (Fig. 2) of the later time of the Moorish artists, who were probably the introducers of this manufacture into Sicily and Italy. Both Spanish and Italian "majolica," as it is called, was decorated as to its surface with "lustre," an effect produced by the reduction by heat of a film of metal from certain metallic salts which, in their reduced state, reflect light with ruby, green, purple, and other tints.

The knowledge of this property of metal, however, preceded the introduction of the enamel ware. The common pottery of many Continental countries is to this day covered with this tin enamel; and it formed the basis of the ware known as Delft,



Fig. 3.—RHINISH JUG, STONEWARE, SALT GLAZE.

which was produced in Holland in enormous quantities and exported for use in England very largely in the 17th and 18th centuries. Dutch potters introduced this manufacture into Lambeth, where it continued to be made until within living memory. It was superseded by the cheaper and better earthenware of Staffordshire.

The method of laying a coating of white pipe-clay on to a common body was the ordinary one of decorating tiles and other pottery ware all through the Middle Ages in this and other European countries. It was an obvious thing to scratch away and remove parts of this coating to show in contrast to it the ordinary body of the ware; but the great artistic ware made by this method is the Persian or Rhodian ware (Fig. 1, B). The same method also exists to this day in India and other parts of the East, especially in Scinde, and has been the one used in many modern revivals of artistic ware in England, France, and India.

The lead-glazed wares have been for many centuries the most commonly used of all the various methods of production, and still are the most widely produced of any. These wares were probably the only ones known in Europe until the discovery of tin enamel in the 15th century.

Specimens of lead-glazed ware have been found in Assyria and Egypt, though it is probable that in these cases the lead was used as a flux for certain colours. Ancient examples are found in southern Italy, in Pompeii, and other places, and exist to this day in the common as well as in the better wares of Staffordshire. A simple example of this method is an ordinary bread-pan. Henri Deux ware of the 16th century is probably the highest example, and this ware has commanded a higher price than any other.

Of unglazed pottery there is an absolutely unbroken tradition of manufacture from prehistoric times to the flower-pot made to-day. It has subserved the humblest uses, and has also embodied the loftiest ideals of beauty the human mind has reached in the best types of Greek pottery.

Porcelain (Fig. 1, C) is a Chinese invention of very great antiquity, and is characterised by an intensely semi-vitreous body, and is glazed by a very hard preparation, and is unlike any of the above-mentioned wares. After its general introduction by the Dutch in the 17th century, it was extensively imitated in Europe, and by its beautiful surface and glaze and imperviousness drove out the more artistic tin enamel and Delft wares from household use. The effort to imitate cheaply this beautiful porcelain body led to the invention of our ordinary every-day table ware, which by its cleanliness has superseded the wooden platter and the pewter or Delft plate of the last century, and is one of the most ordinary necessities of our daily life.

Pouched Rat, a popular name for the American burrowing rodents of the family Geomyidæ (especially *Geomys bursarius*), and for some South African Hamsters, from the fact that they possess cheek-pouches.

Poughkeepsie, the capital of Dutchess county, New York, United States, America, lies on the left

bank of the Hudson river, 73 miles N. of New York. Founded by the Dutch at the beginning of the 18th century, it received its city charter in 1854. There are good public buildings, an opera-house, and fine public library. The observatory connected with Vassar College enjoys high repute. Among local industries may be reckoned iron-founding, brewing, glass-making, and pottery.

Poultice, CATAPLASM, an external application usually made of linseed meal or bread and boiling water, and applied as hot as can be borne to painful or inflamed parts. The chief virtue of a poultice consists in its being a convenient form of applying heat. Sometimes a little mustard or other stimulating substance is used in making a poultice, with a view to producing counter-irritation.

Poultry, a general term including domestic fowls, ducks, geese, turkeys, etc., kept by man, and reared for the table, for the sake of their eggs, etc., or for ornamental purposes. Most, if not all, of our domestic breeds of fowls are descended from the Jungle Fowl of India (*Gallus bankiva*), a form not much unlike the modern game-bird. Domestication took place at an early period; references to the domestic fowl occur in the writings of Aristotle, and according to some the bird was introduced into Britain by the Romans, though Cæsar says that he found the hen and the goose in a state of domestication, though the Britons did not eat them (*de Bello Gal.*, v. 12). The best breeds of fowls for the table are the Dorkings, Game-Birds, and the French Fowls. The first-named are probably the best of all; the meat is not only abundant and of good quality, but is produced in greatest quantity in the choicest parts—the breast and wings; and no breed is so easily got into good condition for the market. Among the best breeds for laying are the Hamburgs, Houdans, the Mediterranean breeds (Anconas, Leghorns, Minorcas, and Spanish). For general purposes, that is, for table-fowls and layers, the Chinese or Americans are probably the best. There are many “fancy” breeds of the domestic fowl which have no economic value, but are bred either for show purposes or for the beauty or strangeness of their plumage. Of Ducks, the best-known varieties are the Aylesbury (with white plumage), the Rouen, Pekin, and Cayuga. There are other varieties, and distinct species, which are kept as ornamental water-fowl.

Of late years the question of poultry-farming has excited a great deal of attention in this country. Its importance will be at once apparent when it is said that Great Britain annually pays about £6,000,000 sterling to Ireland and to Continental nations for eggs and poultry, which, under proper conditions, would be produced at home by the British farmer and cottager. Poultry-farming as a separate industry seems to have proved a failure up to the present time. England appears to be the only country where such experiments have been tried, and the failures have been such as to preclude hope of success. The countries which send us poultry and eggs have tried no such experiments. On the Continent and in Ireland

the breeding of fowls for the table and the production of eggs for the market are not separate industries, but supplemental sources of income to farmers and dwellers in the country parts. The fattening in France, however, is a special business, the birds being bought from those who rear them, and penned and fed by hand or with a machine that forces fattening food, chiefly buckwheat, into the crop. Poultry-raising and the production of eggs might be advantageously carried on in this country by farmers and by those who have land attached to their houses, for in such cases the birds can pick up a good deal of food for themselves, and their manure is an important item. The speedy preparation of birds for the market and the systematic collection of eggs are of great importance if profit is to be made, and the manner in which the commodities are sent to market has a great effect on their ready sale. Good breeds of table-fowls should be chosen, and the eggs sent off, if possible, every other day (if it is impossible to do so every day), for prime poultry will always fetch its price, and a new-laid egg is worth much more than one a week old.

Pound, a piece of land or a building where goods which have been seized as distress are placed by the distrainor; as soon as this has been done the goods are in the custody of the law. It is either pound overt, that is, open overhead (used for cattle), or pound covert; goods liable to be damaged by the weather or stolen must always be impounded in a pound covert.

Pound (symbol lb., from the Latin *libra*) is the unit of mass in England, and the word has its equivalent in several other European countries, although it does not always express the same mass. It is said that its weight in England was derived from that of 7,680 well-dried and perfect grains of wheat, but this would obviously be liable to error. The British standard unit of mass is the Imperial standard pound Avoirdupois—a mass of platinum kept at the Exchequer Chambers; this contains 7,000 grains, while the pound Troy contains only 5,760. 2·2 lbs. are nearly equivalent to 1 kilogramme in the metric system. The word pound has another use: a pound of silver was used as a standard of money by the Romans, and hence was adopted in this country. This amount of silver was at one time made into twenty shillings, but, with characteristic artfulness, Edward II. made twenty-five from it, and subsequent monarchs reduced the shilling till, at one time, nearly three hundred were coined from a single pound. The number now made is sixty-six; but the word pound is altered in meaning, and is now applied to a sum of twenty shillings. The gold sovereign has now replaced the silver pound as a standard of value, the twenty shillings being merely tokens.

Poundal is the unit of force in the British system of units, and is that force which, acting on a mass of one pound for one second, produces in it a velocity of one foot per second. It is therefore equal to $\frac{1}{g}$ the weight of a pound; that is, about one thirty-second.

Poussin, NICOLAS (1594–1665), a great French painter, was born at Les Andelys, in Normandy. He won his reputation while living at Rome, and in 1640 was made painter-in-ordinary to Louis XIII. of France. Three years later he returned to Rome, where he died. His best pieces, *The Last Supper*, *The Labours of Hercules* series, are in the Louvre.

Povindah (Persian *Parwinda*, “a bale of goods”), a term applied generally to all Afghans engaged in trade, and particularly to the group known specially as Povindahs, whose territory extends along the western Sulimân range between the head-waters of the Gomul and Lora rivers. These comprise ten main sections, who have always lived mainly by the caravan trade which they have organised between Afghanistan and India. In times of tribal or border warfare all went armed, and had often to fight their way through hostile or predatory bands on the routes between their territory and the Indus valley. The Povindahs appear to be a branch of the Ghilzaes, whose domain borders them on the west.

Powder. [GUNPOWDER.]

Power, an authority given by one person to another to act for him, or to do certain acts, such as granting leases, raising portions, or the like, also to modify the use of an estate which he has at his disposal; in short, it may be aptly defined as “an authority enabling one person to deal with an interest which is invested in another.”

Power, in engineering, is the rate at which work is done by any motor. If an engine is capable of doing 33,000 foot-pounds of work per minute, it is said to develop one horse-power, which unit was originally intended to represent the rate of working of a horse. In the C.G.S. system the unit of power is the watt, which is ten mega-ergs per second; this is equivalent to a current of one ampère working through a resistance of one ohm, and is equal to $\frac{1}{746}$ horse-power.

Powers, HIRAM (1807–73), American sculptor, was born at Woodstock, Vermont, the son of a farmer. He was successively librarian in an hotel at Cincinnati, clerk in a store, a watchmaker's apprentice, and superintendent of the waxwork department of the Western Museum. In 1835 he came to Washington, and modelled busts of several statesmen, but two years later went to Florence, where he passed the rest of his life, and produced his *Ere*, *Greek Slave*, *Indian Girl*, and other works.

Powhatans, North American Indians, a branch of the Algonquian family, formerly the dominant people in the present states of Virginia and Maryland. All appear to be now extinct, but the name will always be remembered in connection with the romantic episode of Captain John Smith, who was saved from a cruel death by Pocahontas (q.v.), daughter of a Powhatan chief. Descendants of their union are said still to survive in Virginia.

Poynter, EDWARD JOHN, was born in 1836. He studied art in England and at Paris under Gleyre, and first exhibited at the Royal Academy.

in 1862. In 1869 he was elected A.R.A., and in 1871 was appointed Slade professor at University College. In 1876 he was chosen R.A. He was for several years director at South Kensington, and principal at the training school, and in 1879 published *Ten Lectures on Art*. Among his best pictures are *Atalanta's Race* (1878), *Diadumene* (1885), *On the Terrace* (1889), and *A Visit to Æsculapius* (1880).

Pozzo di Borgo, CARLO, CONTE DI (1764-1842), the lifelong enemy of Napoleon, was born near Ajaccio. He became a partisan of Paoli, and was one of the chief administrators of the island under the English. Having once broken with his early friend Bonaparte, he devoted his life to his ruin. Driven from Corsica in 1797 he came to London, and in the following year went to Vienna to form a European coalition against the Consular government. In 1803 he entered the service of Russia, but after Jena again retired to Austria and England. Returning to Russia in 1812, he continued his schemes against Napoleon, from whose service he seduced Bernadotte. He continued in the Russian service till 1835, dying seven years later at Paris.

Pozzuoli (ancient *Puteoli*) stands on the N. shore of the bay of the same name to the W. of the Gulf of Naples, Italy. The harbour, sheltered by Posilipo on one side and Miseno on the other, does a fair amount of coasting trade, and in early times was one of the chief ports of Rome. At present the chief interest is centred in the grand ruins, which include the Serapeum, bearing traces of submergence in the sea, and the vast amphitheatre. The cathedral of St. Proculus, formerly a temple to Augustus, contains the tomb of Pergolesi.

Praed, WINTHROP MACKWORTH (1802-39), was born in London, and educated at Eton and Trinity College, Cambridge. At school he was celebrated for his contributions to *The Etonian*, and at the university was 3rd classic and Chancellor's medalist for English verse. He was called to the bar in 1829, and next year entered Parliament as a Tory. In 1834-35 he was secretary to the Board of Control. He died of consumption. His *Poems*, which are in a very light vein, were edited in 1864 by Rev. Derwent Coleridge.

Præmunire, an offence against public order intimately connected with our political history, and the subject of many stringent statutes long since dormant. It takes its title from the words of the writ preparatory to the prosecution thereof, "*præmunire facias A. B.*" (*i.e.* cause A. B. to be forewarned) "that he appear before us to answer the contempt wherewith he stands charged, which contempt is particularly recited in the preamble of the writ." The chapter of a cathedral church incurs liability to "a præmunire" if it fail to elect as bishop of the see the person recommended by the sovereign to that office. Space will not permit of further examples.

Prætor, a Roman officer of state. Down to 367 B.C. the title was applied to the consuls, but after that date the office was made separate, and

the prætor (who was a patrician) was a kind of third consul. He had the curule chair, the imperium, and was attended by six lictors. At a later period the prætor became mainly a judge, and two were appointed—the *prætor urbanus*, who dealt with city affairs and could not go more than ten miles from its walls, and the *prætor peregrinus*, who dealt with cases in which Romans had disputes with strangers and who administered a system of equity. Other prætors were appointed as the tide of conquest spread, so that by the time of Julius Cæsar there were sixteen. Under the Empire the number varied from twelve to sixteen.

Prætorian Guard was established under the Roman Republic to guard the commander (prætor). Augustus raised the strength of the *cohortes prætorie* to three cohorts, and later to nine with a body of horse. Tiberius brought the whole force to Rome, and established them in the *castra prætoria*. Vitellius formed sixteen cohorts of 1,000 each, and the prætorians received double pay, many privileges of extra rank, and the like, and a gratuity of £150 upon retiring after 12 to 16 years' service. The Prætorian Prefect was a man of much importance, and the whole body became a formidable political power, making and unmaking emperors at will. They were abolished by Constantine the Great in 312 A.D.

Pragmatic Sanction, in European history, signified at first a decree as to Church affairs issued by the head of a legislature. Thus, Charles VII. in 1438 secured the rights of the Gallican Church in accordance with the decrees of a Council at Basel by a Pragmatic Sanction, and a Diet of Mainz in 1439 issued a similar instrument. The name was also applied to the arrangement by which the Emperor Charles VI. secured his dominion to his daughter Maria Theresa, thus causing the War of the Austrian Succession. In 1759 Charles III. of Spain issued a Pragmatic Sanction by which he ceded the kingdom of Naples to his third son in 1759.

Prague, the capital of Bohemia, stands on both banks of the Moldau, 155 miles N.W. of Vienna. On the left bank are the Hradschin and the Kleinseite quarters; these are connected by a stone bridge, a chain bridge and five others with the Altstadt, now encircled by the Neustadt and the Judenstadt or business quarter. Among the chief public buildings are the Wyscherad (or citadel), the old palace of the kings, the palace of Wallenstein, the cathedral of St. Veitz or Vitus, the Theinkirche (associated with the memories of Huss and Tycho Brahe), and the old town hall. The Carolinum, or university, for which Prague has been celebrated throughout its history, was founded by Charles IV. in 1348, and attached to it is the Clementinum, with a fine library. Linen, cotton, silk fabrics, jewellery, sugar, glass, are made here, but the commercial importance of Prague depends on its position as the centre for the distribution of goods by rail and water. It was stormed in 1741, 1742, and 1744, and besieged in 1757. In 1848 its Liberal sympathies led to another attack,

and it was seized, but without bloodshed, in 1866, when the treaty between Prussia and Austria was signed there. It is at this moment torn by dissensions between the Slavonic and Teutonic elements in the population, the former gradually extinguishing their rivals.

Prairie Dog (*Cynomys ludovicianus*), a small American rodent from the prairie regions of the western states. Some authorities reckon a second species (*C. columbianus*) from the west of the Rocky Mountains. They are gregarious animals, and their burrows are called prairie-towns or villages from the mounds which are thrown up in every direction. These animals are about a foot long, stoutly-built, with reddish-grey fur. They feed on roots and grains. The burrowing-owl and the rattlesnake are constantly found in prairie towns. The former probably comes for shelter, the latter for food.

Prairie Hen. [GROUSE.]

Prakrits (*Prakrita* = "natural," "artless"), collective name of all the Aryan languages of India intermediate between Sanskrit and the Neo-Sanskritic (Gaurian) tongues. The earliest specimens are the rock and pillar inscriptions of the Buddhist King Asoka, 3rd century B.C.; oldest grammar by Vararuchi 1st century B.C. Several known varieties: Shâhbâzgarhi and Girnar, the oldest and nearest to Sanskrit; Pali (q.v.); Jaina of the Bhagavati, sacred book of the Jains; Paisâchi; Shauraseni, the chief vernacular used in the Hindu drama; Mahârashtri, allied to, if not the source, of the western Gaurian tongues (Sindhi, Panjâbi, Gujarâti, Marâthi); Magadhi (q.v.). The Prakrits, all of which are still highly inflectional, were current generally from about 600 B.C. to 600 or 700 A.D., merging gradually in the modern vernaculars.

Praxiteles, the great Greek sculptor, flourished at Athens in the 4th century B.C. Little is known of his life, and most of his works have perished; but in 1877 his *Hermes Carrying Dionysus* was discovered at Olympia. His reputation was derived from his statues of Aphrodite at Cnidus and other places, Dionysus at Elis and Athens, Eros at Thespiæ, and from several Apollos.

Prayer-Book. The full title of the English Prayer-book shows that, besides furnishing forms of "Common Prayer" (*i.e.* Morning and Evening Prayer), it is intended to satisfy the other requirements of public worship and secure the due celebration of the various rites and offices of the Church. It is, in fact, a compilation, the different parts of which fulfil the functions of the Breviary, Missal, Pontifical, and Manual or "Prymer" on which they are severally based. The task of adapting these works of Catholic devotion to the needs of Protestant congregations was undertaken by the English reformers, under the lead of Cranmer, in the last years of Henry VIII.'s reign. The first outcome of their efforts was a translation of the Litany, revised by Cranmer in 1544. This again appeared in English, together with the Creed, the Lord's Prayer, the Ten Commandments,

and sundry Canticles and Collects, in the "King's Prymer" of 1545. After the death of Henry VIII. the work of forming an English Prayer-book was carried on with increased energy and zeal. The "Order of Communion" (1548), a temporary production adapted to the administration of the sacraments in both kinds, which was now for the first time enjoined, was speedily followed by the First Prayer-book of Edward VI. (1549), containing all the services of the Church in a revised form. Although the First Prayer-book was received with general favour, the influence of Bucer, Peter Martyr, and other foreigners of Calvinistic views, soon caused a demand for further changes. Reverence for antiquity was wholly absent from the minds of those who drew up the Second Prayer-book of Edward VI. (1552); their sole desire was to approximate as closely as possible to the teaching of Geneva. Most of the differences between the present Prayer-book and that of 1549 are due to alterations made at this period. The point to which a return was made after the accession of Elizabeth was not so far from that of 1552 as might perhaps have been anticipated. At the Hampton Court Conference (1604) a form was adopted which was nearly the same as that now in use. Few changes were made beyond the addition of certain thanksgiving prayers and the latter part of the Catechism. "Laud's Prayer-book," which in some points returned to the First Prayer-book of Edward VI., was introduced into Scotland in 1637, but the attempt to enforce its use led to a revolution. Under the Commonwealth the use of the English Prayer-book, whether in public or private, was made a penal offence. As a result of the Savoy Conference (1661), a discussion between twelve bishops and twelve Presbyterians, some further alterations were made, but they all showed the predominance of the ecclesiastical party. The use of the revised Prayer-book, which was now reduced to the form in which we possess it, was enjoined by the Act of Uniformity in 1662. The "Sealed Books" or printed copies preserved at all cathedrals, in the Law Courts at Westminster, and in the Tower of London, remain the standard for determining the genuine text. The attempt to introduce further modifications in 1689 was opposed by Convocation and fell to the ground.

Praying Insects, a family of Orthoptera (q.v.) known as *Mantidæ*. Their popular name is derived from their habit of standing upon their four hind-legs with the front pair raised in the air as if in prayer. The best-known species is *Mantis religiosa*, Linn., common in the south of France.

Precession. For a long period of time it has been observed that the positions of the celestial pole and the equator have altered. The pole of the equator, in fact, describes a small circle round the pole of the ecliptic, and the intersections of equator and ecliptic—the equinoxes—move backwards on the ecliptic through a distance rather less than one minute per year. Hence the sun has to travel about one minute less each year before he reaches the same equinox again, *i.e.* he reaches that point rather earlier every year. Hence the

phenomenon is known as the "precession of the equinoxes." This precession has considerable effect upon the recorded positions of stars, since it increases their longitude by the amount of the precession, and effects a change in their declinations and right ascensions. It takes about 26,000 years for the equinox to make a complete revolution. The cause of this movement is the attraction of the sun and moon on the bulging part of the earth at the equator, which thus alters the direction of the axis. The phenomenon of precession was first noted by Hipparchus.

Predestination, a term expressing the eternal purpose of God, whereby He preordains all that happens. This doctrine has divided Christians into two sections ever since the days when it was raised by Pelagius (q.v.), who upheld the freedom of the will in opposition to Augustine. The latter maintained that all natural impulse to good ceased with the Fall, and his system (which he elaborated with much intellectual skill) was accepted as the orthodox doctrine by the Council of Arausio (529). The doctrine was carried to an extreme point by Gottschalk, a monk of the 9th century, and at the time of the Reformation it was upheld by Calvin with an uncompromising austerity which has made "Calvinism" synonymous with the holding of predestinarian views.

Pre-emption. The Pre-emption Act, which came into force in the United States in 1841, confers on any person who has settled on a piece of public land a prior claim to obtain the same by purchase, provided that it does not exceed 160 acres. The price is uniform in all cases. Title to land is acquired more speedily in this manner than by means of the Homestead Laws.

Pre-existence, the doctrine that the individual soul existed in some other form before it became connected with the human body to which it is now attached. This view is the natural outcome of Pantheism, or at least of that form of it which teaches that all Spirit is self-subsistent, and cannot be created or destroyed at the behest of a Divine intelligence.

Pregnancy, SIGNS OF. Suppression of the menses is usually the first warning of the pregnant condition; it is by no means an absolutely reliable sign, as such suppression may be due to other causes, and a periodic flow sometimes occurs in spite of the fact that pregnancy exists. Morning sickness usually occurs during the second month of pregnancy, and lasts until the fourth month. Changes in the breasts and increase in the size of the abdomen are manifested in the third month as a rule, and "quickening" may occur at about this period. The one certain sign of the existence of pregnancy (the detection of the sound of the foetal heart) is rarely observed by the physician much before the sixth month. The duration of pregnancy is usually about 275 days.

Prejevalsky, or PRJEVALSKY, NICHOLAS (1839-88), the Russian traveller, served in the army for several years. In 1871-73 he travelled from Pekin

to the upper waters of the Yang-tse-Kiang. In 1877 he made the first attempt to enter Lhasa, and in 1879 had penetrated within 150 miles of the place when stopped by the authorities of Thibet. He subsequently explored the upper course of the Hoang-ho. Two more attempts were made, but Prjevalsky died at Karakol in western Turkestan.

Pre-Raphaelite Brotherhood, the name assumed by several young painters and sculptors who, towards the middle of the present century, revolted against the current conventionalism in art and determined to seek for inspiration in a close study of nature. The movement was probably due in larger measure to William Holman Hunt (q.v.) than to his younger associates John Everett Millais (q.v.) and Dante Gabriel Rossetti (q.v.), who owed much—especially the latter—both to his precept and example. The name Pre-Raphaelite was chosen because the founders of the school considered that in his later years Raphael sought to model his style on that of Michelangelo and Leonardo da Vinci without an independent study of nature, thereby departing from the example of his immediate predecessors.

Presburg (Magyar *Poz-sony*), a town in Hungary, standing on a height above the Danube, 34 miles E. of Vienna. Formerly the capital of Hungary, it still remains the seat of the Diet and the place of coronation of the kings. The royal palace overlooking the town has never been restored since the disastrous fire of 1811, but among existing structures are the fine Gothic cathedral of St. Martin, the Hall of Diet, and the palace of the Archbishops of Gran. Tobacco, silk, leather, paper, glass, and mirrors are the chief objects of industry, and there is a considerable trade in corn and other agricultural products. The Treaty of Presburg between France and Austria was concluded here in 1805.

Presbyopia. [EYE.]

Presbyterians, a body of Christians, whose theory of Church government presupposes the identity of the "presbyters" (Greek *presbuteroi*, "elders") and "bishops" (*episkopoi*, "overseers," "guardians") mentioned in the Epistles and the Acts of the Apostles. They maintain that there was no distinction of office among the ministers commissioned by Christ to feed the flock of God, confute heretics, administer baptism and the Eucharist, and lead the prayers of the congregation; and that the elevation of bishops to a higher rank was a gradual innovation which grew out of the choice of a permanent "moderator" or speaker of the presbytery. Modern Presbyterianism dates from the Reformation. The views of Luther and Calvin on this point were the same, but it is to the latter, who possessed a genius for organisation, that the Presbyterian form of government is due. In accordance with his scheme presbyters are chosen by the Council of State in consultation with the people, each receiving an allotted share of work. Calvin's views were adopted by the Reformed Churches of France and Scotland, the latter of which is now divided into three separate

bodies, viz. the Established Church, the Free Church, and the United Presbyterians. The first presbytery formed in England was that opened at Wandsworth, in Surrey, in 1572. During the Civil War the great majority of the Puritans were Presbyterians, and looked for guidance to the Westminster Assembly (q.v.), but afterwards the Independents gained the ascendancy, and Presbyterianism became discredited, although most of the Church livings were held by Presbyterian ministers up to the Restoration. Since that time the Presbyterians have not occupied a prominent position among English Nonconformists. On the Scottish disruption in 1843 the English presbyteries joined the English congregations of the "United Church." In 1876 they were all united under the title of the "Presbyterian Church of England." In Ireland Presbyterianism is the largest denomination in the province of Ulster. The number of Presbyterian communicants in the United States in 1889 was 1,424,042.

Prescott, WILLIAM HICKLING (1796–1859), was born at Salem, Massachusetts. He graduated at Harvard in 1814, and for a time studied law. After travelling in Europe, he determined, in spite of his defective eyesight, to pursue a literary career, and in 1826 began his Spanish studies. Ten years later appeared *The History of Ferdinand and Isabella*, which was followed by *The Conquest of Mexico* (1843), and *The Conquest of Peru* (1847). In 1850 Prescott came to England, and was made D.C.L. of Oxford, and in 1855 he published the first two volumes of a *History of Philip II.* which he did not live to finish. In the following year appeared his continuation of Robertson's *History of Charles V.*

Prescription (*Præscriptio*), a title to incorporeal hereditaments acquired by long and continued possession. Before the Prescription Act 2 & 3 William IV., c. 7, the possession required to constitute a prescription must have existed time out of mind or beyond the memory of man—that is, before the reign of Richard I.; but now the period of possession necessary to constitute a title by prescription is in many cases considerably shortened by the above Act.

President. The President of the United States is elected at intervals of four years by delegates chosen by the electors in each state, their number being the same as that of the senators and members of Congress. As a matter of fact, however, these delegates are always pledged to support the candidate nominated by the National Conventions of either party. The President is commander-in-chief of the army and navy, and also of the militia when it is engaged in active service. It is his function to see that the laws are duly administered, and every bill passed by Congress requires his signature, unless his authority is overridden by that of a two-thirds majority in both houses. He grants pardons and reprieves (except in cases of impeachment) and makes treaties, subject to the approval of two-thirds of the Senate. The consent of the Senate is also necessary in the choice of ambassadors, consuls, and other officers,

whose appointment is in his hands. The President's annual salary is \$50,000.

Pressensé, EDMOND DE (1824–91), was born at Paris, where he became a Protestant minister in 1847, after studying at Lausanne, Halle, and Berlin. His most important works were, *Histoire des Trois Premiers Siècles de l'Église Chrétienne* (1858–77), *L'Église et la Révolution* (1864), and *Jésus Christ, Son Temps, Sa Vie, Son Œuvre* (1866). These and other works were translated into English and German. In 1871 he was elected a deputy in the French Assembly, and in 1883 a senator.

Pressgang. Impressment was a recognised means of recruiting the British navy from the reign of John to that of William IV., and, though it has now fallen into disuse, the laws regulating and thus sanctioning it have not been repealed. Sailors, fishermen, bargemen, and, on urgent occasions, landsmen were (with certain stated exceptions) liable to service between their nineteenth and their fifty-sixth years.

Prester John, the name given in the Middle Ages to a supposed Christian king and priest of great power and splendour. Otto, Bishop of Freisingen, makes him conquer the Persians and Medes in a great battle and attempt to reach Jerusalem. About 1165 a letter from "Presbyter Joannes" to Manuel, Emperor of the East, was circulated throughout Europe. Of this letter nearly 100 MSS. exist. In 1177 an epistle seems to have been written by Pope Alexander III. from Venice to "John, the illustrious and magnificent king of the Indies," regarding the establishment of a church and altar at Jerusalem. Gibbon and other writers make the subject of the first of these letters Gur Khan, the king of Khitái or Cathay, who, however, was probably not a Christian; while the great Mongol conqueror Genghiz Khan is probably to be identified with later bearers of the name. Prester John's realm was at first supposed to be in Central Asia, but from the 14th century onwards it was placed in Africa, and he becomes thus almost certainly identical with the king of Abyssinia, who was a Christian.

Preston, a market-town and municipal and parliamentary borough on the north bank of the Ribble, Lancashire, 27 miles north-east of Liverpool. It attained some importance as the port of the Ribble in Saxon times, and played a part both in the Great Rebellion and the Jacobite risings of 1715 and 1745. Its present prosperity, however, dates back to little more than a century ago, when linen-weaving was introduced. Great improvements in the river have tended to develop a large shipping trade, especially in coal, and, as a centre of railway and canal traffic, Preston possesses unrivalled advantages. There are excellent public buildings. Three spacious parks afford means of recreation. The borough returns two members to Parliament.

Presumption (*Præsumptio*), that which is presumed or believed in the absence of direct evidence to the contrary. A presumption has been classed as a violent, a probable, or a light presumption, according to the amount of weight which attaches to it.

Pretender. [STUART.]

Prévost d'Exiles, ANTOINE FRANÇOIS (1697-1763), was born at Hesdin, Artois. He was educated by the Jesuits, and in 1720 became a Benedictine of St. Maur, but more than once ran away from his studies and enlisted as a soldier. He also passed six years in Holland and England. His first novel, *Mémoires d'un Homme de Qualité*, appeared in 1728. It was followed by *Cléveland* and *Manon Lescaut*, his masterpiece. The Abbé Prévost also translated *Pamela* and *Clarissa Harlowe*. Another novel of his which is still read is *Histoire d'une Grecque Moderne*. Prévost was chaplain for many years to the Prince de Conti, and died suddenly of apoplexy.

Prévost-Paradol, LUCIEN ANATOLE (1829-70), was born in Paris and educated at the Collège Bourbon. In 1855 he was professor of literature at Aix, but soon after became a leader-writer on the staff of the *Journal des Débats*. During the following years he published a collection of literary and political essays, and in 1865 was elected to the Académie Française. He was chiefly, however, known as an opponent of the Empire. He accepted, nevertheless, the post of ambassador to the United States from Ollivier, but committed suicide at New York almost immediately afterwards.

Priam, king of Troy, was son and successor of Laomedon. By his second wife, Hecuba, he was father of Hector, Paris, Cassandra, and numerous other children.

Price, RICHARD (1723-91), was a native of Glamorganshire. He had been for some years a Nonconformist minister in London, when a volume of his sermons gained for him the acquaintance of Lord Shelburne, who, when he became Prime Minister, made him his private secretary. In 1771 Price wrote *An Appeal to the Public on the Subject of the National Debt*, from which Pitt probably derived his idea of a sinking fund. He had previously attracted attention by papers on actuarial and statistical questions. Price, however, made his name still more widely known by his pamphlets directed against the war with America, and in 1778 he was invited to become a citizen of the United States. He also welcomed the French Revolution, and was warmly denounced by Burke in his *Reflections*.

Prickly Heat, a papular skin eruption of common occurrence in tropical countries.

Prickly Pear, the popular name of the genus *Opuntia*, cactuses, numbering over 150 species, native to hot, dry regions from California to Chili. They mostly have jointed, flattened, fleshy stems with minute deciduous leaves, in the axils of which the tufts of spines and the flowers arise. The latter are usually yellow or orange, with indefinite sepals and petals graduating into one another, numerous free included stamens, a single style, and 5 to 7 stigmatic lobes. The fruits are inferior berries, pear-shaped and bearing tufts of small spines. These plants have become naturalised in Southern Europe, North Africa, and the Canaries. They are

much used for hedges, and in Mexico for rearing the cochineal insect. Their sweet fruits are refreshingly cool, and sugar is extracted from them.

Pride, THOMAS, colonel in the Parliamentary army, was a native of London. At the battle of Preston in August, 1648, he first distinguished himself; but he is chiefly known in history as having been entrusted with the "purging" of the House of Commons from the Presbyterian element, who in December, 1648, wished to conclude a treaty with Charles I. He was one of the regicides, and a member of Cromwell's Upper House, and died in 1658.

Prideaux, HUMPHREY (1648-1724), came of a Cornish family. He was educated at Westminster under Dr. Busby, and at Christ Church, Oxford. After having held various benefices in different parts of the country, he was in 1681 named Canon, and in 1702 Dean, of Norwich, having been also Archdeacon of Suffolk. His chief work was, *The Old and New Testament Connected in the History of the Jews*.

Priest, in its largest meaning, applies to all persons who conduct the worship of a god or gods by means of certain fixed ceremonies, among which sacrifice has always been regarded as the most important. The word is derived through French and Latin from the Greek *presbuteros*, "elder" [PRESBYTERIANISM]; but, owing to the pre-Christian associations which had early gathered round it, it is never used to translate *presbuteros* in the New Testament. In the Authorised Version "priest" translates the Hebrew *kohēn* (Septuagint, *hiereus*; Vulgate, *sacerdos*), and rightly so, for in both the Greek and Latin Churches the functions of the *presbuteros* came to be identified, or at least closely assimilated in idea, with those of the ministers of the ancient Jewish religion. The transition to those who held a like position in the great heathen religions of antiquity was then natural and easy. In the Christian religion the identification of the *presbuteros* and the *hiereus*—the notion that the priest is a mediator between God and man—was in great measure due to the conception of the Eucharist as a propitiatory offering. The religious movement which culminated in the Reformation was a protest against the sacramental character of the priesthood, and there is now no point concerning which there is greater divergence of view between the Roman and reformed churches, or even between members of the same communion in the reformed churches, than the nature of the priestly office. The Church of England in her "office of institution" ascribes sacerdotal functions to the priesthood—viz. the offering of sacrifice, praise, and thanksgiving in the Eucharist, "the declaring and pronouncing the absolution and remission of sins," and the blessing of the people in God's name.

Priestley, JOSEPH (1733-1804), was born at Fieldhead, Yorkshire. He was Nonconformist minister at Needham Market, Nantwich, Leeds, and Birmingham, and was also for some time classical tutor at Warrington Nonconformist

Academy. While here he was created LL.D. of Edinburgh, and in 1766, in consequence of his electrical researches, was elected to the Royal Society of London. Next year he published his *History of Electricity*. He attracted the attention of Lord Shelburne, but, after the appearance of his *Disquisitions on Matter*, he lost the position of librarian and literary companion. In 1791 he was obliged to leave Birmingham after his chapel had been destroyed by a mob who disapproved of his sympathies with the French Revolution; and, after living three years at Hackney, he became an American citizen. Priestley's chief claim to remembrance is his discovery of oxygen, which he called "dephlogisticated air."

Prim, JUAN, MARSHAL (1814–70), was born at Reuss, in Catalonia. He distinguished himself in the first Carlist War as a supporter of the Regent Christina, and when peace was made became the leading opponent of Espartero, whom in 1843 he drove from the capital. He then became governor of Madrid, but was displaced and imprisoned by Narvaez. After his achievements in Morocco he was created Marquis de los Castillejos. In 1868, having assisted in the overthrow of Isabella, he became Minister of War. He procured the election of the Duke of Aosta to the Spanish throne, but was immediately afterwards assassinated by the Carlists.

Primary Rocks, a term formerly applied in geology either to the plutonic igneous rocks (q.v.), such as granite, under the belief that they were the first rocks to form on the cooling of the earth from its primitively molten condition, or to the Palæozoic rocks (q.v.), as opposed to the Secondary and Tertiary. Being thus hopelessly ambiguous, it is now generally disused.

Primates, the first order of Mammals, containing Man, the Anthropoid Apes, Monkeys, and Lemurs. Linné included the Bats, which now form a separate order (*Chiroptera*).

Prime Number is a number which is not divisible by any number except itself and unity; 1, 2, 3, 5, 7, 11 are examples of such numbers, to which there is no limit. Two numbers are often said to be prime to each other when they have no common factor except 1.

Primogeniture, the principle by which the real estate falls to the eldest son, to the exclusion of the younger sons and daughters. [BOROUGH ENGLISH, GAVELKIND.]

Primrose, a corruption of *primerole*, the abbreviation of the French *primererole*, the Italian *primaverola*, a diminutive of *prima vera*, the "first spring flower," a name applied formerly to the privet but now referring to *Primula vulgaris*. This plant has a truncate or premorse rhizome; a rosette of wrinkled obovate leaves with netted venation prominent beneath; a very short peduncle with an involucre of linear bracts; long, pink-tinged, hairy pedicels; a slightly inflated, five-angled tubular calyx; a spreading, salver-shaped, generally pale yellow corolla, with notched petals and an orange centre with thickened folds. This

ordinary form with shortened peduncle is termed *P. acaulis*, that with it elongated, *P. caulescens*. The flowers exhibit dimorphic heterostyly (q.v.), giving rise to the variations popularly called "thrum-eye" and "pin-eye," and also vary greatly



PRIMROSE (*Primula vulgaris*).

in colour, white and red being the chief exceptional tints. It is the origin of the garden Polyanthus (q.v.). Early blossoms often open at Christmas, or sooner.

Primrose League, a Conservative society founded in 1883 in memory of Lord Beaconsfield, whose favourite flower is said, on no sufficient authority, to have been the primrose.

Primula, the typical genus of the gamopetalous order Primulaceæ, comprising about fifty perennial herbaceous species. They have umbellate inflorescences; radical leaves; regular five-lobed calyces and corollas, five included epipetalous stamens opposite the corolla-lobes; a capitate stigma; simple style; one-chambered ovary, with many-ovuled free central placenta; and a capsule splitting above into ten teeth. A few species occur in North America. *P. japonica* (with many-tiered umbels), *P. sinensis* of China, the cowslip-like *P. sikkimensis* of the Himalayas, the auricula (*P. Auricula*), primrose (q.v.), cowslip (q.v.), and oxlip are familiar forms.

Primulaceæ. [PRIMULA.]

Prince. The origin of this title is frequently assigned to the denomination of *princeps senatus*, applied to the most respected member of the Roman Senate, and afterwards, it is said, adopted by Augustus. The view now accepted, however, is that the title adopted by Augustus was that of *princeps* simply, in the sense of "foremost citizen." With the growth of Imperial power the term *princeps* came to imply sovereignty or dominion. Unlike "king" and "monarch," it is applied to dependent as well as supreme rulers, and even to persons of royal or noble blood who exercise no authority at all. In England its use is confined to those who are closely related to the reigning sovereign.

Prince Edward Island, a province of Canada, lies off the south shore of the Gulf of St. Lawrence, and is separated from Nova Scotia and New Brunswick by Northumberland Strait. About 150 miles long by 34 miles broad, it has an area of 2,133 square miles, the surface being undulating with no elevations higher than 500 feet. It has a fertile soil and a mild climate, so that heavy crops of wheat and other cereals with fruits and vegetables are raised; but the chief industry consists in fishing. Cardigan Bay to the E., Richmond Bay to the N., Hillsborough Bay to the S., and Egmont Bay to the S.W., divide the island into three peninsulas linked by isthmuses of no more than three or four miles broad. Until 1758 it was nominally French, and was known as the Isle St. Jean. The British then captured it, and have held it ever since.

Prince of Peace, the name given to Manuel de Godoy, Duke of Alcudia (q.v.) (1767–1851). He received the title on account of his share in the Treaty of Basel (1795). On the abdication of Charles IV. he was so unpopular that he narrowly escaped death.

Princeton, a borough and township of New Jersey, United States, America, about half-way between New York and Philadelphia on the Pennsylvania Railway. It is the seat of Princeton or New Jersey College, founded in 1746. Here, too, is the oldest Presbyterian Theological Seminary in the States. Washington defeated the British at this spot in 1777, and in the Nassau Hall, now part of the College, the first Continental Congress met in 1783.

Principia, the name given to the chief street in the Roman *castra* or camp.

Printer's Ink. [INK.]

Printing, as the etymology of the word *premo*, *pressum*, "to press," implies, is marking by pressing one thing upon another. Letterpress printing is the art of imprinting characters or letters on paper, parchment, and other materials by means of a press. The characters are in relief—as distinguished from intaglio, as in copperplate printing—and a pigment or ink is applied to the raised surface. Pressure causes this ink to be transferred to the material to be printed. In typography, which is the principal branch of letterpress printing, the surface inked consists of movable interchangeable types or casts taken from them called stereotypes (q.v.). The precursor of letterpress printing was engraving (q.v. *ante*). In 1454 Letters of Indulgence were printed which embodied a fundamental alteration in the then method of printing. They were done from movable types cast in a mould. Two years later an entire Vulgate Bible—the "Mazarine" Bible, so-called from the library in which the most notable specimen was discovered—was printed from movable type. The oldest type-printing with an authentic date printed in is the Psalter of Fust and Schoeffer, dated 1457.

An interminable controversy has been carried on for several hundred years as to the actual inventor

of printing by movable type, but no definite result has been arrived at. The first printers seem to have regarded their art merely as a means of cheapening books, which were previously written; and they did not, apparently, anticipate the tremendous results which have been the outcome of the popularisation of literature by means of the printing press. Historians differ chiefly as to whether Laurence Koster of Haarlem or John Gutenberg of Mainz (q.v.) is entitled to the honour of having first printed from types. It is manifestly impossible here to state the arguments adduced in behalf of either supposed inventor, but the evidence seems to make in favour of the latter. The date of the invention, however, may be approximately fixed at the year 1450.

The art spread with marvellous rapidity throughout Europe, and the result was the production of many books of considerable beauty in regard to text and illustrations. It was brought to England in 1476 or 1477 by William Caxton (q.v.). He adopted typography as a method for multiplying copies of his compositions. He was not a good printer, his style being much behind that of several contemporary Continental typographers. His books, apart from their literary merits, have little interest except that arising from their rarity. They are all in "black letter" or Gothic type, very similar to that of the first Bible above mentioned, the characters of which were copied from the manuscript service books of the period. Roman letter, in which English books and newspapers are now almost exclusively printed, is copied from the writing of the Italian scribes of the 15th century, which was famous for its beauty. It did not make its appearance in England until 1518, when Pynson printed a book in it, the type being probably obtained from abroad. From 1477 to the early part of the 16th century printing spread to different towns in Britain, and books were produced in large numbers, the demand for them, at first extremely limited owing to the paucity of readers, increasing with remarkable rapidity as education became extended. In 1530 books and tracts had become so numerous that they were regarded as a possible danger to the state and society, and a form of censorship was established. The press was in that year first licensed, and a period of decadence set in which lasted for more than 150 years. Subjected to restriction and repression, the art decayed. There was little competition between printers, many of whom enjoyed privileges and monopolies; old and bad type was used, and excellence of typography quite disregarded. In 1695, by the abolition of the licensing system, the press became emancipated, and an era of revival set in. Its results may be seen in almost every book printed during the early part of the eighteenth century. There arose a demand for good types and clear impressions. For many years the best types had to be brought from abroad, as the art of letterfounding had suffered in conjunction with that of printing. The demand was followed, as usual, by the supply, and Caslon produced founts which for beauty and finish were not surpassed in Europe. Great printers, like Bowyer, Watts, and Bettenham,

educated the reading public in the points of technique which constitute typographical excellence, and ultimately there raged a "bibliomania" for costly and sumptuous books which stimulated not only the art of printing but the whole of its auxiliary arts, including paper-making and book-binding. This was succeeded by the period of revolution and development in which we now live. It began with the invention of the steam press, first used for printing the *Times* in 1814. Books and periodicals, published at popular prices, attained enormous circulations. This enabled publishers to spend previously unheard-of sums of money upon their production. Issues such as those of the house from which this volume emanates would have been regarded as merely visionary before the invention of the steam press, and, if called for, the demand could not have been met. The steam press also rendered possible many improvements which could not have been made when there was in use only the old hand-press—notably the printing of large woodcuts. All the accessories of typography, in the way of methods of illustration and ornamentation, have since been cultivated with an ever-increasing assiduity and success. Not only so, but entirely new arts have been originated, such as stereotyping, electrotyping, and photo-process engraving. The printing trade has, unlike other trades, not suffered by the general introduction of machinery; the art has been brought to a state of perfection which the old printers would find it impossible to realise. The best books of to-day are, notwithstanding much current criticism and detraction, in their style and attributes greatly superior to those of any previous age.

Amongst the best books for general readers on the origin and early history of printing are:—*Early Printed Books*, by E. Gordon Duff (London, 1893); *Early Illustrated Books: a History of the Decoration and Illustration of Books in the 15th and 16th Centuries*, by Alf. W. Pollard (1893); *Invention of Printing*, by Theo. L. De Vinne (1876); *History of the Old English Letter-founders, with Notes on the Rise and Progress of English Typography*, by Talbot B. Reed (1887); *Biography and Typography of Wm. Caxton*, by Wm. Blades (1882); *Pentateuch of Printing*, by Wm. Blades (1891). See also articles *ante*, CAXTON, ENGLISH LITERATURE, ENGRAVING, GUTENBERG, ETC.

Limitations of space preclude anything like a technical description of the many processes which together constitute the practical art of letterpress printing. We confine ourselves to a sketch of the manner in which a book like the present is produced. This page is printed from a surface composed of *types*, each representing a single letter (with the exception of such "ligatures" as *ff*, *fl*, etc.), or a punctuational point, or a reference mark, together with the *spaces* that divide the words and paragraphs—to the number of more than 8,000 separate pieces or "stamps." The whole of the characters of any one "sort" have been cast from one *matrix*. When this and other pages are printed off—we designedly overlook stereotyping (q.v.)—the types of which they are composed are decomposed or "distributed," and are available for

being again composed to form other pages. In this capability consists the essence of typography—the *interchangeability* and possibilities of endless *combinations* of the separate types. The *size* of type used for this page is called *brevier*; by measurement it will be found that 111 lines would go to the foot. Larger types are those known as *bourgeois* (102), *long primer* (90), *small pica* (83), *pica* (72 to foot). Smaller types are: *minion* (122), *nonpareil* (144), *ruby* (166), *pearl* (180), *diamond* (207). Much larger types are manufactured, but those named are chiefly what are used in printing books and newspapers. The size of type, it should be mentioned, cannot invariably be ascertained by measurement, as there may be spaces between the lines of type, which would then be called "leaded"; otherwise, as in the present instance, it is said to be "set solid."

The width of each of our columns is $2\frac{1}{2}$ inches; printers would call it "15 ems pica." The "em" is the square of pica body, and is the unit of typographical measurement; as 6 picas go to the inch, $2\frac{1}{2}$ inches, of course, are equal to 15 picas. One-half of the width of the em is the en, which is regarded as the average width of the various letters of the alphabet. Hence we have a ready method of ascertaining the contents or number of letters in a given superficies of printed matter. Each of our columns is 23 ems *brevier*, or 46 ens *brevier*, in width. There are 66 lines in the column. Accordingly 46×66 gives, approximately, 3,036 as the number of letters and spaces in a column.

The method of manufacturing types is briefly described *s.v.* TYPEFOUNDING. When a complete assortment of type, called a *fount*, is received, the printer distributes each sort into the compartments (or "boxes") of shallow trays (or "cases"). The capitals and small capitals go into an "upper" case—so named on account of its position on the sloping desk-like stand (or "frame"). The other letters are kept in the "lower case," and are so designated. In writing "copy" for printers the intention of an author to have a capital is intimated by the drawing of three, of a small capital of two lines, underneath the letter or word. Italic letters are kept in separate cases, and are indicated in manuscript by one line beneath.

The compositor or type-setter, having his copy before him, holds in his left hand an instrument, the "composing stick," into which he places the types as they are taken one by one from the boxes, with the thumb and first finger of the right hand. The "stick" has an adjustable slide, whereby the width of the line (the "measure") is regulated. Each letter is picked up separately, and steadied in its position in the stick by the thumb of the left hand. With the view of expediting composition, a number of letters forming a word or an affix or prefix have been cast in one piece, called a "logotype," but this system has not been found to answer the purpose. Between the words are placed "spaces," which are shaped like types but are shorter, and thus escape inking, and consequently do not appear. The spaces are (besides the hair space, used chiefly in ornamental composition) the thin, of which 5 are equal to one em, the middle

(4 to em), and the thick (3 to em). Of the same nature as spaces are quadrats or "quads," the larger kinds of which are used mainly to blank out the ends of paragraphs. The en quadrat is half of the em, which, as already mentioned, is the square of the body. Each of the paragraphs in this page is "indented" with an em-quad.

Before completing the line, the compositor notices whether an entire word can be "got in" or whether it is necessary to divide it, placing a hyphen after the portion dis severed. It may be possible to get in the word complete by using thinner spaces; or, to make the line the right length, thicker or extra spaces may be used. It is imperative that the line be precisely "full," and the operation is called "justifying." The next line is set in the same manner, and succeeding ones, until the stick, which may hold about a dozen lines of brier, is quite full. It is then "emptied" by grasping the matter between the extended second finger and thumb of each hand, and the matter is placed on a shallow tray with upright flanges to support the letters, called a "galley." A "proof" of this—a sample impression—is then printed or "pulled," and compared with the copy by the "reader," otherwise the corrector of the press. The copy will probably be read aloud to him by the reading boy. The proof, as corrected, goes back to the compositor, who makes the rectifications marked by the reader. Another proof is pulled, called a "revise," and is compared with the first proof. If the composition is sufficiently accurate a "clean" proof is pulled for the use of the author. It reaches him in the shape of a long "slip," comprising about two of these columns. The author reads and corrects the proof. There are a number of arbitrary marks used in correcting, which we have not space for setting out. As far as the author is concerned, the chief marks required will be these: If a letter is upside down, it is crossed through, and 2 written in the margin; if there is a redundancy in letters or words, they are also crossed through and δ (initial of delete) written in the margin. If more space is wanted between words, the mark $\&$ is made; if letters are to be closed up, \subset . After each correction must be placed an oblique stroke as "and/"—this last being most important. The author's proof is returned to the printer, and any directions contained in it are attended to. Errors of workmanship in first proofs are corrected by the compositor at his own expense; alterations from copy made at the instance of the author are chargeable to him as "author's corrections." When satisfied with the matter, the author writes on it "For press," to signify that it may be printed off.

The type is now to be made up into pages on a wider galley. The lines at the head and between the columns are made by strips of brass called "rules," the white spaces between them and the types by leads. The head-line and the folio are put in, and the page, duly gauged for accuracy, is tied up with string, and then slid off upon an "imposing stone," really a large table bearing a smoothly-planed plate of iron. Here the pages are made up into "sheets." This book consists of sheets of sixteen pages. These are "imposed" together,

that is, they are so arranged that they will when the paper is printed and folded read consecutively. Imposing for different sized sheets requires much experience on the part of the compositor. Between the pages, corresponding to the margin of the printed sheets, pieces of metal or wood, called "furniture," are placed. The strings being now removed, an iron frame, called a "chase," is chosen of the required dimensions. The type is "locked up" in the chase, or fastened up tightly by means of wedges called "quoins" acting against tapering pieces of wood called "side and footsticks." Type and furniture, as it stands in the chase, is called a forme or form. After being levelled or "planed down," it is ready to go to the machine room, unless it has to be stereotyped, in which case the type is not printed from.

The processes already mentioned belong to the department of printing called "case work;" now we come to "press work." The hand-press consists of two essential parts—an iron bed on which the flat forme of type is placed, and a platen, a flat plate of iron. The forme, on which is the paper, is pressed between the two by levers and links. Hinged to the bed is the tympan, which is a double iron frame on which parchment is stretched. Between the inner and outer parchments blanketing or paper is placed to prevent the platen injuring the type, and for other reasons. The forme is inked by means of "rollers"—cylinders three or four inches in diameter made of a composition of glue, treacle, glycerine, or other materials. Printing ink is a mixture of lamp-black, oil, and varnish, and of a treacly consistency. The sheet of paper is placed on the tympan, which is folded over on the forme, the bed and carriage run in under the platen, which is brought down by the "handle," a long lever acting upon an ingeniously-contrived system of levers. The carriage is then run out, the sheet removed, and the process repeated with other sheets. Two men, one "rolling" and the other pulling the handle, thus print about 250 sheets of paper, on one side only, per hour.

Machines or mechanical presses greatly increase this production by performing some of the operations automatically. Machines are of many designs, but in principle nearly all come within two categories. In the first the impression is given by a revolving cylinder geared to the flat bed for the forme, which travels backward and forward underneath the cylinder. In the second, the types (in reality, curved casts from them) are fixed on the periphery of the cylinder. Both the type cylinder and the impressing cylinder rotate—hence the machine is called a "rotary" one—and during the movement the paper is printed. In both the cylinder and the rotary machine the inking is done by rollers revolving as parts of the general arrangement. The cylinder machine prints only one side of the paper, at a speed of about 1,000 per hour. A double cylinder machine, however, prints both sides, or "perfects" the sheet, before it is removed, by bringing it successively into contact with the two formes, which are at the two ends of the machine. In both, single sheets are fed in by hand. In the rotary machine a reel or web of paper is used,

which is wound on a spindle at one end. The paper is brought in contact with cylinders bearing the two formes, and is consequently printed on both sides. This is the most improved method for newspapers, which are, after being printed, cut off from the reel and folded automatically. A sheet of the *Times* can thus be printed at the rate of about 24,000 per hour; or, if a double width reel is used, at the astounding rate of 48,000 per hour. A supplement may be simultaneously printed, insetted, and the whole paper pasted down the back. This makes the highest achievement, up to the present time, of engineering for printers. Sheets of fine book-work are, however, usually worked off on cylinder and perfecting machines.

The operations of the composing room have not been much expedited by the introduction of labour-saving appliances, chiefly owing to the fact that the work of the compositor is largely a mental one—quite different in character from the cycle of processes involved in press and machine work. A great number of type-setting machines have been invented. Several of these, suitable for plain book or newspaper work, enable a man to compose and justify 5,000 letters per hour regularly. Complementary to them are distributing machines, which distribute the composed type into the receptacles of the composing machine. Recently "line-casting" machines have been introduced with considerable success. In using these the compositor sets up or assembles, not separate types, but matrices, from which casts are taken after a complete line has been composed. The casts (linotypes, or lines of type) are equivalent to lines of ordinary letters, and the matrices, after being used for producing them, are automatically distributed. The printer is altogether independent of the type-founder. The greater portion of a large number of newspapers throughout the kingdom are now composed by machinery at the rate per machine worked by one man of about 7,000 letters per hour, about seven times the speed of hand composition.

Prior, MATTHEW (1664–1721), was educated under Dr. Busby at Westminster School, and became scholar of St. John's College, Cambridge, where, with his friend Charles Montague, he wrote *The Story of the Country Mouse and the City Mouse*, a parody of Dryden's *Hind and Panther*. Some time after leaving Cambridge he obtained, through the influence of Dorset, the post of secretary to the English ambassador at The Hague. In 1697 he brought over to England the Treaty of Ryswick, and in the following year was transferred to the Paris embassy. In 1711 he was sent to Paris with proposals of peace, and in the following year accompanied Bolingbroke thither. For his share in the Peace of Utrecht he was impeached by the Whigs and imprisoned, and spent the rest of his days in retirement. Prior owes his reputation to his poems, collections of which were published in 1709 and 1718. *Alma, or the Progress of the Mind* is a long poem in imitation of the author of *Hudibras*; but it is in his occasional verse, short lyrics and epigrams in the manner of Ovid and Horace, that he chiefly shines.

Priory, a religious house ranking next to an abbey, and often dependent upon it.

Priscian (PRISCIANUS CÆSARIENSIS), the Latin grammarian, lived in the 6th century. His chief work was his *Grammatical Commentaries*, a learned treatise in eighteen books, which remained a standard work throughout the Middle Ages. He also wrote two poems in hexameters.

Priscillian, the founder of a Gnostic heresy, was a Spaniard of noble birth. Some time after his ordination as Bishop of Avila he began to be suspected of heretical views, and at the Synod of Saragossa in 381 he was excommunicated. He and his three chief followers appealed in vain to the Pope at Rome; but the sect he had founded continued to flourish till, after having been again condemned, they were put to death at Trèves in 385 after a futile appeal to Cæsar. The Priscillianist sect continued to exist for more than sixty years after this.

Prism is a solid whose ends are any equal and parallel plane figures and whose sides are parallelograms. When its ends are triangles (and this is the most usual form of prism), it is extensively used in practical optics for producing refraction and dispersion (q.v.), and may be conveniently used for finding the refractive index of a substance. An "erecting" prism is frequently used when pictures of experiments done in a lantern are thrown upon a screen. The object-glass would cause the top of the apparatus to appear at the bottom of the screen; and, to avoid this somewhat confusing effect, a carefully-polished prism (of definite angular form) is placed in front of the object-glass.

Prisons. Incarceration, whether regarded as a reformatory or merely as a punitive process, is not a very ancient method of dealing with crime. In ancient Athens and Rome it was resorted to rather as a means of securing the persons of those who awaited trial or were doomed to execution than as an end in itself. At Athens persons who owed money to the State, or were unable to pay fines, could be placed in prison until the obligation was discharged. These continued to be the main uses of prisons up to a very recent period; their usual occupants were debtors or others whom it was necessary to detain for some ulterior purpose. In England, as in other countries, the condition of prisons (owing to the neglect and mismanagement of the State) became a grave social evil, which went on increasing till it excited the reforming energy of John Howard. They were always overcrowded, for gaol deliveries did not take place at fixed intervals, and a criminal's family were often allowed to reside with him in the prison. When Howard made his first journey through England, in 1773, he found that most of the gaols were loathsome underground dens, in which the prisoners were kept in a half-starved and almost naked condition, with nothing to lie upon but filthy and rotten straw. No distinction of sex was observed, and the inmates were completely at the mercy of the gaolers, who extorted enormous fees for the most trivial concessions.

The most ordinary sanitary precautions were neglected, and no attempt was made to check the vice and debauchery which naturally thrive amid such surroundings. The value of Howard's labours was recognised by Parliament, but it was long before any effective steps were taken in the direction of reform.

At this time the commonest form of punishment was death, which might be incurred by petty larceny no less than murder. The only other penalty for grave offences was transportation, which originated in the Vagrancy Act of 1597. After the establishment of American independence it became necessary to devise some new method of punishing criminals, unless the death penalty was to be still further extended. An Act was therefore passed substituting hard labour at home (1776), and two years later the Penitentiaries Act, which was partly the work of Howard, provided the means of giving effect to the preceding statute. In this Act all the principles now recognised in prison legislation—including solitary confinement, care for the health of the prisoner, and the attempt to effect his reformation—are very clearly enunciated. It was nearly 40 years, however, before any penitentiary of the kind suggested was actually completed. In the meantime the hulks established in 1778 (and not entirely discontinued till 1857) formed a very inadequate substitute. The discoveries of Captain Cook revived the idea of transportation, and in 1788 the first batch of Australian convicts was landed at Port Jackson. The evils attending this method of punishment had already become manifest before Millbank Prison (q.v.) was at last opened (1816) in accordance with the Act of 1778. Millbank was the first of a new class of prisons, the history of which it will be well to follow out before returning to those of the ordinary kind. The report of a parliamentary committee condemning transportation in 1838, and still more the growing repugnance of the Australian colonies to admit convicts, forced on the attention of the Government the urgent necessity of erecting penitentiaries at home. A system was accordingly devised by Sir George Grey, then Home Secretary, which (with some modifications) remains in force at the present time. William Crawford had recently returned from a mission to the United States, in which he had been much impressed by the salutary effects of the "Pennsylvanian System," which provided for the complete seclusion of each prisoner. The Government determined to adopt it, but this could only be done gradually, owing to the expense involved in erecting buildings containing so many separate cells. As absolute loneliness had frequently led to disastrous results in America, it was thought advisable that prisoners should not be entirely deprived of all human society. Pentonville Prison, erected in accordance with the new plan under the superintendence of Sir Joshua Jebb, was opened in 1842. At Pentonville, Millbank, and certain provincial prisons which suited the purpose, convicts passed through the first of the three stages assigned to them in Sir George Grey's scheme. Here during a period of nine months, in which a strong effort was made to bring them under religious and moral influences, the convicts were engaged in

some industrial occupation, with no society but that of the prison officials. In the second stage they were associated together in gangs and employed in the construction of public works. The first prisons erected for this purpose were Portland (1847), Dartmoor (1850), Portsmouth (1852), and Chatham (1856). The works thus constructed by convict labour include the breakwater at Portland and the fortifications and part of the dockyard at Chatham. It is impossible to avoid all intercourse between the men when they are at work, but pains are taken to minimise the amount of conversation. At all other times, both by day and night, the prisoners remain in complete seclusion. At the close of the second stage the convict received a ticket of leave, the condition annexed to his release being his removal to a colony till the term of his sentence expired. It was supposed that during the first two stages his character would have undergone a change, and that in a new country, amid unfamiliar surroundings, he would have a better opportunity of making a fresh start in life. The colonies, however, took a different view of the matter; and the opposition raised, among others, by Tasmania and the Cape of Good Hope, necessitated the Penal Servitude Act of 1853. By this Act penal servitude took the place of transportation in all sentences under 14 years, the term to which the criminal was condemned being shortened so as to equal in amount the period he had previously passed in prison before receiving a ticket of leave. Thus a sentence to seven years' transportation, became one to four years' penal servitude. Control over the released convicts by means of the ticket-of-leave system was, however, still maintained. The new arrangement did not commend itself to the country at large, mainly owing to the rapid increase in garrotting and similar crimes during the latter part of 1862. Although the connection between these crimes and short sentences and ticket of leave was never clearly made out, a parliamentary inquiry into the whole system was instituted in 1863, as a result of which an Act was passed again, making five years the minimum term of a sentence of penal servitude (1864). The committee also expressed the opinion that convicts were too well treated, and that a less liberal diet and harder work would tend to make the dread of penal servitude more effectual in preventing crime. At the same time, a stop was put to the practice of allowing prisoners large gratuities as a reward for diligence and good conduct. But it still remained the convict's interest to conduct himself well; for by the "mark system," which was now introduced, the period at which he passed from the second to the third stage was made to depend upon the number of marks earned by his industry and good behaviour. Transportation came to an end in 1867, when Western Australia refused to receive any more convicts. The most important changes since that date have been the separation of confirmed criminals from the others (1878), the formation of the Star Class, consisting of convicts "not versed in crime" (1880), and the reintroduction of a term of penal servitude lasting three years (1891). Each convict prison is under the control of a separate governor, assisted by a staff of officials and

clerks, together with a chaplain and medical officer, schoolmasters, and a steward at the head of the store-keeping department. The governor is responsible to the Board of Directors (constituted in 1850), one or more of the members of which visit each prison at frequent intervals. A second visiting body, consisting of unpaid members, which acts independently of the other, was formed as a further safeguard in 1880.

We may now return to the gaols reserved for "imprisonment," the term which is applied to sentences not exceeding two years. During the period which followed Howard's labours the laudable efforts of Parliament to introduce improvements formed a striking contrast with the actual condition of the prisons. Little or no attention was paid to statutes such as those directing a classification of the prisoners (1784) and requiring the appointment of a chaplain to every gaol (1814). The disgraceful state of Newgate was disclosed by a parliamentary inquiry in 1814, but no alteration for the better was made during the ensuing years, excepting the marvellous change in the character of the female prisoners brought about by the labours of Mrs. Elizabeth Fry. In 1818 there were 59 prisons in which no distinction was observed between the sexes. The labours of the Prison Discipline Society brought the state of the gaols more prominently before the notice of the country and of Parliament, and in 1823-24 Acts were passed laying down general regulations for the maintenance of health and making provision for the education and profitable employment of the prisoners. The Municipal Corporations Act (1835), by abolishing the anomalous privileges which enabled boroughs to evade these enactments, removed one of the chief obstacles to the reform of abuses and the introduction of a uniform system. Uniformity of treatment in regard to solitary confinement, diet, and similar matters was recognised as the great end of legislation in the Acts of 1835 and 1839. By the former of these statutes prison inspectors came into existence, and the latter gave rise to the office of surveyor-general of prisons, whose duty it is to see that the gaols built fulfil the requirements of health and discipline. Since the return of the mission to the United States the advantages of solitary confinement had become generally recognised, and in the six years that followed the erection of Pentonville, 54 prisons were built on the same model in various parts of the country. All previous statutes were embodied in the Prison Act of 1865, which entered into minute details on all points and exacted a penalty for every infringement of its regulations. Yet great diversity prevailed till the passing of the Act of 1877, by which the management of prisons was transferred from the local authorities to a body of commissioners appointed by the Home Secretary. These gaols are inspected by "visiting committees" elected by the magistrates each year in quarter sessions. A criminal sentenced to "imprisonment" passes through four stages, the treatment in each stage being less severe than in that which precedes it. The rate of his progress from stage to stage depends on his industry and good conduct.

"First-class hard labour" such as the treadmill, is exacted from him in the first stage, industrial labour in the others.

Privet (*Ligustrum vulgare*), a British shrub belonging to the olive tribe. It grows 8 or 10 feet high, with small, opposite, entire sub-evergreen leaves, and panicles of white flowers, followed by black globular fruits (nuculanes). Both calyx and corolla are four-lobed, and there are two stamens. The berries are used to colour port wine and to paint playing-cards.

Privileged Communication or CONFIDENTIAL COMMUNICATION, in law, a communication made under such circumstances that it is not a matter of right to prove it as an admission by calling the receiver of it as a witness.

Privy Council. The Royal or Privy Council originated in the Curia Regis, which during the Norman period exercised judicial, legislative, and administrative functions. Its functions were afterwards differentiated, thus giving rise to the Courts of Exchequer, King's Bench, and Common Pleas on the one hand, and the Royal Council on the other. The process by which the latter arose was, however, gradual. Thus in 1178 Henry II. referred difficult judicial or financial cases to a small circle of "sapientes" or councillors. A council of this description exercised large but vague powers during the minority of Henry III., and, after maintaining its existence throughout his reign, became the Council of Regency during Edward I.'s absence in Palestine. The powers of the Council constantly increased, though not without occasional protests on the part of the Commons. The right of nominating the members acquired by Parliament under the Lancastrian kings is a constitutional landmark, since it was intended to put a check on the abuse of the royal prerogative. It was at this time that the name "Privy Council" came into use. In 1437 Henry VI. restored the nomination of members to the Crown, and from the reign of his successor till the Puritan revolution the Council continued to be an instrument of arbitrary government in the hands of the sovereign. Even in judicial matters it was invested with extraordinary powers at variance with the common law, and out of it grew arbitrary tribunals such as the Star Chamber (q.v.) and the Court of High Commission. Its judicial functions were curtailed by the Long Parliament (16 Car. I., c. 10), and, having become unmanageable through the large number of its members, it was superseded towards the close of the 17th century by an informal cabal, composed of "cabinet councillors." After the definite recognition of Cabinet government by William III., the Privy Council in its corporate capacity practically became obsolete. Regarded in that light it is merely a dignified body into which all politicians of mark are admitted, with the title of Right Honourable. Use, however, is still made of the Council to facilitate the transaction of public business. The Board of Trade was at first one of its committees,

and the origin of the Local Government Board and the Board of Agriculture, to each of which duties previously discharged by the Council have been transferred, is virtually the same. The Education Department is still a committee of this kind, the Minister of Education being technically Vice-President of a Committee of Council. The Judicial Committee of the Council is really a court of law with special powers, which include the decision of appeals from colonial and from ecclesiastical courts.

Probability, mathematically treated, seeks to reduce to some definite form the value of the chance of any event occurring, or the value of any statement considered with respect to the conditions under which it was made. If it be equally likely that a certain operation succeed or fail, the chance that either happens is represented by $\frac{1}{2}$. It might be said that $\frac{1}{2}$ is the mathematical value of complete ignorance; for if a coming event may happen in two ways, and we have some knowledge which leads us to think it will favour one mode of occurrence, then the probability will not be $\frac{1}{2}$ that this mode is the one followed, but will be a fraction greater than $\frac{1}{2}$. Pascal was the first scientist who investigated the subject from a mathematical point of view, and he has therefore been regarded as the founder of the science. A problem was propounded to him by M. de Méré which is now known as the "problem of points." It is this:—Two players have each gained a certain number of points when the game is interrupted; how should the stakes be divided? Pascal and Fermat both considered the question at some length, and were thence led to other problems of a similar nature. Many problems deal with the chance of two particular events happening together when we know the chance of each by itself. Thus, suppose A.'s chance of obtaining a scholarship is $\frac{2}{5}$ and B.'s chance of winning a prize is $\frac{5}{6}$, the probability that both succeed is $\frac{2}{5} \times \frac{5}{6} = \frac{1}{3}$; the odds are 2 : 1 against. The chance that both fail is $(1 - \frac{2}{5}) \times (1 - \frac{5}{6}) = \frac{1}{10}$, or 9 : 1 against; the chance of A.'s success and B.'s failure is $\frac{2}{5} \times \frac{1}{6} = \frac{1}{15}$, that of A.'s failure and B.'s success is $\frac{3}{5} \times \frac{5}{6} = \frac{1}{2}$. It is seen that $\frac{1}{3} + \frac{1}{10} + \frac{1}{15} + \frac{1}{2} = 1$, which states that one of the combinations *must* happen, an obvious result. Experience of the past gives us some idea of the probability of future events in many cases. When a person invests his money in a lottery ticket, his chance of winning is determined by the number of prizes and blanks; but his *expectation* is considered as his chance of winning multiplied by the value of the prize. Bernoulli showed that this does not measure the advantage to any person, for that will depend on his worldly wealth, and he considered that any sum of money would have a definite "moral value" for different persons, the moral value being roughly equal to the sum divided by the fortune of the person. This is a perfectly common way of viewing things, and it is considered that £1 is the same to a man whose income is £100 as £10 is to a man receiving £1,000. The income tax is to a large extent paid in accordance with this principle. The great practical uses of the theory of probability are

in determining the nearest true results from a series of observations (*i.e.* in giving a value to each observation and its accompanying error), and in the application of statistics. In the calculations of insurances and annuities probability plays a most important part, and has led to the construction of tables of mortality whose use is recognised in all commercial countries.

Probate, the official copy of a will or testament made out on parchment under the seal, formerly of the ordinary, but now of the Court of Probate, and usually delivered to the executor, or "administrator with will annexed," as it is termed where no executor is appointed by the will, together with a certificate of the will having been proved. It is the authority under which an executor or administrator acts. [EXECUTOR.]

Proboscidea, an order of Mammals, or a sub-order of Ungulates, of which the elephant (q.v.) is the sole living representative.

Proboscis Monkey (*Nasalis larvatus*), from Borneo, allied to the genus Semnopithecus. The head and body of the adult male are about thirty inches long, and the tail is nearly as much more. The fur is brightly coloured, and the nose is enormously developed, whence the name.

Probus, MARCUS AURELIUS, Roman Emperor, was a native of Pannonia. His military qualities led to rapid promotion, and when the Emperor Tacitus died he was proclaimed his successor by the soldiers. During a short reign of six years the enemies of Rome were beaten back on all sides, and Persia in particular was compelled to make peace; but Probus lost his short-lived popularity by the strict discipline he endeavoured to enforce, and in 282 was murdered near Sinnium, his birthplace.

Proclus, was born at Constantinople early in the 5th century. He studied Aristotle and Plato under Heliodorus at Alexandria, and was instructed in theurgic mysteries at Athens by a philosopher named Plutarch and the priestess of Eleusis. He was banished from the city by the Christians on account of his aggressive proselytism, but was afterwards allowed to return, and died there in 485. Proclus was surnamed Diadochos, or "the Successor," because he followed Syrianus as head of the Athenian school.

Procopius, the historian of the reign of Justinian, was born at Cæsarea. He accompanied Belisarius in his campaigns against the Persians, the Vandals, and the Ostrogoths, and wrote their story in his *Historiæ*. He then returned to Constantinople, and enjoyed great favour with the emperor, whose public works he described in his *De Edificiis*, and of whose court he has left a dark picture in the *Anecdota aut Historiæ Arcana*. He died probably about 565.

Procter, BRYAN WALLER (1787–1874), better known by his pseudonym of "BARRY CORNWALL," was born in London and educated at Harrow. He was called to the bar in 1831, and was for thirty

years a commissioner in lunacy. He wrote several volumes of graceful lyrics, and memoirs of Edmund Kean and Charles Lamb, and had a play produced at Covent Garden; but he is chiefly to be remembered as having been the intimate friend of the great writers of two generations, of Wordsworth, Scott, and Lamb no less than of Tennyson, Browning, and Thackeray. ADELAIDE ANNE PROCTER, his daughter, was born in 1825 and died in 1864. She gained some poetic fame by her *Legends and Lyrics* (1858-60).

Proctor is derived through Middle English and Old French from the Latin *procurator*, "one who acts in place of another." Proctors are of three kinds:—(1) University officials whose duty it is to maintain order among the undergraduates and see that the statutes are observed. Nominally, their power extends to Bachelors of Arts also. At night they walk the streets attended by "bull-dogs" who lay hands on the unwary undergraduate abroad without cap and gown. (2) Officers who in Convocation represent either the chapter of a cathedral or the clergy of a diocese. (3) A class of practitioners in the Ecclesiastical and Admiralty courts whose functions are now discharged by solicitors.

Proctor, RICHARD ANTHONY (1834-88), was born in Chelsea, and studied at King's College, London, and St. John's, Cambridge, where in 1860 he was 23rd Wrangler. He early devoted himself to astronomical studies, and gave popular lectures in England, America, and the colonies, besides writing over fifty books, and conducting *Knowledge*, which he founded in 1881. To him is due the theory of the solar corona and the accurate determination of the rotation of Mars.

Procyonidæ, an American family of plantigrade carnivorous mammals, belonging to the Arctoidea, containing the Raccoons and Coatis.

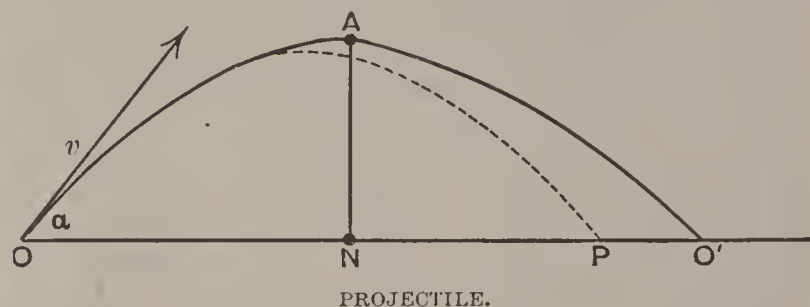
Professor. The use of this term to denote a public teacher in a university seems to have been derived from Italy. In the universities of Germany and Scotland the professors constitute both the governing body and the ordinary educational staff. At Oxford and Cambridge, on the other hand, their office gives them no share in administering the affairs of the university, and attendance on their lectures is not compulsory, their place being taken under the inter-collegiate system by the tutors and lecturers of the colleges which have combined for purposes of instruction. In American universities each branch of instruction is commonly superintended by a professor, assisted by other professors and assistant-professors.

Profit and Loss Account, in book-keeping, the account showing the gains and losses arising from commercial transactions. The profits are placed on the creditor side and the loss on the debtor side of the account.

Profit-Sharing, a system adopted in some industrial establishments by which a workman receives a share of the products of labour in the shape of "profits" over and above his stipulated wage. The plan is said to have been first tried at

Paris by M. Edm. J. Leclaire, a painter and decorator, in 1842. Various improvements have since been made on Leclaire's original scheme. At present the net profits are divided into four portions, one of which is reserved for the provident society and another as wages of management, the remaining half being paid to the labourers in cash. On Messrs. Godin's ironworks at Guise a different system is followed. Here the portion of the returns assigned to each labourer is held back till it amounts to a sum sufficient to purchase a share in the business. In 1880 the interest on workmen's capital was a little under one-eighth of the sum paid in wages. In both these firms the practice is said to have been attended with the happiest results. Profit-sharing has also been introduced into Great Britain and the United States. In 1890 earnings in this form were distributed among 11,000 hands engaged in over fifty establishments in Great Britain.

Projectile. A particle projected into space in any direction may have its velocity resolved into two components—horizontal and vertical. Under ideal conditions the horizontal velocity will remain absolutely unaltered for the whole time of motion, and the vertical component will be accelerated by g (\approx about 32) feet per second. From these two factors the path of the



moving body may be found. Let it start from O with a velocity v in a direction making an angle α with the horizontal OO' ; its vertical component is $\therefore v \sin \alpha$, and its horizontal component is $v \cos \alpha$. Let it reach A , the highest point in its path, in a time t , and draw the vertical line AN . When the particle reaches A its vertical velocity is g , and the velocity upwards when it left O is the same numerically as it would gain if allowed to fall from A to N —that is, $v \sin \alpha = gt$. The space $AN = g \frac{t^2}{2}$, or $t^2 = \frac{2}{g} AN$. $ON = v \cos \alpha \cdot t$, $\therefore ON^2 = v^2 \cos^2 \alpha \cdot t^2$, and, substituting $\frac{2}{g} AN$ for t^2 , we have $ON^2 = \frac{2 v^2 \cos^2 \alpha}{g} AN$. This is the equation to a parabola, A being taken as origin, and it can be shown that every point of the path fulfils the conditions of this equation. It is obvious that this curve is symmetrical about the line AN , and hence the range of flight, OO' , is equal to $2 ON$. But $2 ON = 2 v \cos \alpha \cdot t$; hence substituting for t from the equation $v \sin \alpha = gt$, we have

$$2 ON = \frac{2 v^2 \cos \alpha \sin \alpha}{g} = \frac{v^2}{g} \sin 2 \alpha.$$

If we wish the range to be as great as possible for

the velocity v , we must have $\sin 2\alpha$ as large as possible—that is, $\sin 2\alpha = 1$, $\therefore \alpha = 45^\circ$. In an ideal case, then, a shot fired at an angle of 45° will hit the ground farther away from the gun than if fired at any other angle. The directrix of the parabola is a line parallel to OO' , and at a distance $\frac{v^2}{2g}$ above it, and the parabolic paths of projectiles fired with the same velocity in all directions from O have the same directrix. Also the envelope of these different parabolæ is another parabola. This is approximately exemplified by a fountain of water proceeding from a rose jet. In no practical case is the ideal parabola obtained; the horizontal velocity does not continue unchecked, but is retarded by the resistance of the air. The highest point on the trajectory (as the path is often called) will be nearer to O than A is, and the curve will assume a steeper form (as shown by the dotted line), the range being only OP instead of OO' . The resistance of the air for moderate speeds varies with the square of the velocity, but for very high speeds it varies with the 6th power or more. Hence it is impossible for meteors, etc., to fall to the earth with a speed greater than some fixed amount.

Projection. Let $ABCD$ be points forming a plane or solid figure of any shape which it is desired to project from some point, S , on to a plane. From S , the centre of projection, let lines, or *rays*, SA , SB , etc., be drawn, and let these lines cut the plane of projection in points $A' B' C' D'$. The figure $A' B' C' D'$ will then be a projection of the original figure on the plane. Any surface may be used instead of the plane, and the result is a projection of the figure on that surface. The projection of solids on to a plane in this way is often known as *perspective*. Projection mathematically treated is chiefly concerned with the projection of figures into other figures of the same dimensions. From the projection of plane figures into other plane figures a number of interesting results are obtained, and their application to conics gives many new methods for solving theorems relating to these curves; for it is to be noted that by suitably choosing the centre and plane of projection any conic may be projected into any other conic. For many purposes it is desirable that solids should be represented by drawings on plane paper, and so a simple method of projection is necessary. That known as *orthographic* is the most generally used. It was invented by Monge, and is such that the centre of projection is at infinity, and the rays—which are therefore all parallel—are drawn perpendicular to the plane of projection. It is generally convenient to take a horizontal plane for one projection which is then called the “*plan*” of the figure, and a vertical plane for another, which is then called the “*elevation*” of the figure. In point of fact both drawings are often executed on the same sheet of paper, it being imagined that the vertical plane containing the elevation was simply turned about the axis—the line in which it cut the horizontal plane—till it coincided with the horizontal one. This is known as “*rebatting*” the plane. Any

point on the figure is represented by a point in both plan and elevation, the line joining the two being perpendicular to the axis. A plane is best represented by its *traces*—i.e. the lines in which it cuts the two planes of projection, and which meet on the axis. A line can be represented either by its projections (lines) or its traces (points). Very often it is convenient to take a third plane for more complete representation of the model, and when possible this is taken perpendicular to the other two planes. The projection obtained in this is often known as a *side elevation*. Usually the shape and size of the projection differ from those of the original, and practical problems have frequently to be solved in which it is required to deduce the size of the drawing from measurements of the model, or to discover the size of a required object from the dimensions of the drawings. Other problems of frequent occurrence are to make projections of sections of curved surfaces, and to determine the curve in which two such surfaces cut each other. If we view any natural scene with one eye, and imagine lines drawn from this eye to every visible object, these lines (which coincide with actual rays of light) will cut some chosen picture plane, and if we then draw upon this picture plane the various points and their connecting lines, we should obtain an ideal perspective. To obtain this perfectly is the aim of good drawing, while the painter endeavours to add to the result the effect of the other eye and to indicate distance by the shading of his colours. To give a projection upon a curved surface is a more complicated matter, but such a projection is exemplified in the panorama, the curved surface being a cylinder.

Projective Geometry. [PROJECTION.]

Prolapse, the term applied to the descent of a portion of the rectum (*prolapsus ani*), or of the womb (*prolapsus uteri*).

Prolegs, the appendages on the abdomen of caterpillars by which locomotion is effected. The three pairs of appendages which develop into the legs of the adult insect are not used for walking in the caterpillar; they are small and used for holding the food on which the larva feeds.

Prometheus (“Forethought”) was said to be the son of Iapetus the Titan and Clymene. The oldest form of the myth is found in Hesiod, according to whom Prometheus, having outwitted Zeus and stolen fire from heaven, was chained to a rock, where his liver was torn every day by an eagle and made to grow again at night, while his brother Epimetheus (“after-thought”) was equally punished by the fatal gift of the virgin Pandora. In the *Prometheus Bound* of Æschylus he is the devoted friend of men, to whom he teaches all the arts of life and for whom he suffers all the wrath of Zeus, who, however, finally allows his place on the rock to be taken by the centaur Cheiron.

Promise, an undertaking to do or not to do a certain thing. Promises in law are either express or implied; express, when founded upon the express contract or declaration of the party promising; implied, when the promise is inferred from his acts,

conduct, or peculiar position. Thus the law will always infer a promise by a debtor to pay a debt due to his creditor.

Pronghorn (*Antilocapra americana*), an aberrant antelope, about the size of a fallow-deer, from the prairie-lands of North America. Both sexes bear true horns, which are shed annually. Those of the male are about a foot long, curved backwards at the tip, with a branch directed forwards rather more than half-way from the base. Those of the female are very much smaller.

Proof Spirit consists of a mixture of alcohol and water containing about $49\frac{1}{2}$ per cent. of alcohol. The original proof test was by the ignition of gunpowder. The spirit was poured upon some gunpowder and ignited; if when the liquor burnt out the gunpowder was also ignited the spirit was *over proof*, and *vice versâ*. By law proof spirit has at 51° F. a density $\frac{1}{13}$ relative to water at the same temperature. The number over proof is the quantity of water which must be added to 100 volumes of the spirit to reduce it to proof strength, or that must be abstracted if it is under proof. Thus if a whisky is sold at 25 over proof, if 25 volumes of water were added to 100 of the spirit the result would contain about $49\frac{1}{2}$ per cent. of alcohol. The degree above or below proof is usually determined by the density of the liquor measured by some form of hydrometer or alcoholometer, the form known as Sike's hydrometer being that commonly adopted.

Propertius, SEXTUS AURELIUS, the Latin elegiac poet, was born about 50 B.C. in Umbria. Almost the only material for his biography is derived from his own writings. He began to write at an early age, and was patronised by Tullus and later by Mæcenas. He was a friend of Ovid and an acquaintance of Virgil, but does not seem to have known Horace or Tibullus. The date of his death cannot be exactly fixed. In his elegies Propertius closely followed Greek models.

Propionic Acid, an organic acid of the formula $C_3H_6O_2$, or $C_2H_5 \cdot CO_2H$. It is one of the series known as the *fatty acids*, and is closely allied chemically to acetic acid. It may be prepared by a number of reactions, many of them common to the whole series of the fatty acids. It is a colourless liquid, possessing a pungent odour. It boils at about 140° C. It gives rise to many substitutive derivations, forming two series of monoderivatives and three series of diderivatives. Of the first series the isomeric lactic acids may be taken as examples, the hydrogen being replaced by OH, yielding the compounds $C_2H_4OH \cdot (CO_2H)$. [LACTIC ACID.]

Proportion. Four quantities are said to be in proportion when the ratio (q.v.) between two of them is equal to the ratio between the other two.

Thus a, b, c, d are proportionals when $\frac{a}{b} = \frac{c}{d}$, and

this is often written $a : b :: c : d$. Since $\frac{a}{b} = \frac{c}{d}$ it follows that $ad = cb$, or the product of the

means (b and c) is equal to the product of the extremes (a and d), and $d = \frac{cb}{a}$, which gives a

means of finding a fourth proportion when the three others are known. This is the basis of the arithmetical rule. If $\frac{a}{b} = \frac{b}{c} = \frac{c}{d} = \frac{d}{e}$, the quantities a, b, c, d are said to be in continued proportion. A special case of this is given when there are but three quantities. Then, as $\frac{a}{b} = \frac{b}{c}$, it follows that $b^2 = ac$, and b is said to be a mean proportional to a and c . Also $\frac{a}{c} = \frac{a^2}{b^2}$ —i.e. the

first is to the third in the duplicate ratio of the first to the second. This and many other theorems relating to proportion occur in Euclid's fifth book. Among them may be noted that if $a : b :: c : d$, then $b : a :: d : c$, which is known as *invertendo*; also $a : c :: b : d$ (*alternando*); $a + b : b :: c + d : d$ (*componendo*); $a - b : b :: c - d : d$ (*dividendo*); $a + b : a - b :: c + d : c - d$ (*componendo and dividendo*). Euclid's definition of proportion is as follows:—The first of four magnitudes is said to have the same ratio to the second as the third has to the fourth when any equimultiple whatever of the first and third being taken, and any equimultiple whatever of the second and fourth, if the multiple of the first be less than, equal to, or greater than that of the second, the multiple of the third is less than, equal to, or greater than that of the fourth. This may be algebraically written a, b, c, d

are proportionals when $p \overset{>}{c} \overset{<}{q} d$, according as

$p \overset{>}{a} \overset{<}{q} b$, p and q being any positive integers.

From Euclid's definition stated in this form it is easy to prove the algebraical definition that $\frac{a}{b} = \frac{c}{d}$ and *vice versâ*. The wordiness of Euclid's definition is due to the fact that he made it include incommensurable quantities as well as commensurable ones.

Propyl, the radical, or group of elements C_3H_7 , which exists in a large number of compounds: the propyl compounds—e.g. propyl chloride, C_3H_7Cl ; propyl alcohol, C_3H_7OH ; *isopropyl* iodide, C_3H_7I , etc., the last named radical, *isopropyl*, possessing the same composition but differing in the arrangement of the atoms in the group.

Prosecutor. A prosecutor is one who takes action against another in the name of the Crown. In criminal matters the suit is described as one by "Her Majesty the Queen on the prosecution of A.B. against C.D. (the prisoner)." The prosecutor may be, and usually is, a private person, and he is generally the person specially injured by the crime. When the crime is of a heinous nature, or likely to go unpunished for want of a prosecutor, the proceedings are conducted by the Director of Public Prosecutions in the name of the Attorney-General.

Proserpina (Greek, *Persephone*), the bride of Pluto and Queen of Death, was, according to Homer, the daughter of Zeus and Demeter. The story of her abduction by Pluto first appears in Hesiod. Later writers make Pluto compel him to give her up to her mother Demeter for two-thirds of the year. Her return to the upper world symbolised spring, and she is thus worshipped with Demeter or Ceres as the Goddess of Nature.

Prostate Gland, a glandular body about the size of a chestnut which surrounds the male urethra in the first portion of its course from its origin at the neck of the bladder. Chronic enlargement of the prostate sometimes occurs in males (rarely before the attainment of fifty-five years of age), and leads to difficulty in micturition, and, it may be, to actual retention of urine.

Protection, in political economy, is the system of developing the industries of a country by imposing duties on imported products which compete with those of home industries. [FREE TRADE.]

Proteids. The proteids or albuminoids are an important class of organic compounds. In very many of their properties they closely resemble one another, while their chemical composition, or at least their percentage chemical composition, only varies within slight limits. They all contain hydrogen, carbon, oxygen, and nitrogen, while small quantities of sulphur (and often phosphorus) are usually present. Their importance to the human economy is due to the fact that animals are incapable of deriving their supply of nitrogen necessary for the maintenance of life from inorganic sources of this element. Proteids are hence an essential food-stuff, deprivation of which results in starvation. The proteids in the system pass into the blood only after their conversion into a soluble proteid—*peptone*—which is effected by the fermentation induced by the *pepsin* of the gastric juice and the *pancreatin* of the pancreatic secretion, both of which substances are themselves proteid materials. Amongst the more common of these compounds are: *albumen*, present in white of egg and in blood serum; *myosin*, the proteid material of muscle and lean meat; *casein*, existing in milk and cheese; *fibrin*, present in the blood; *globulin*, a component of many animal tissues; *chondrine*, which exists in cartilage; *vitellin*, in the yolk of eggs. Gelatine appears to be very closely allied to the proteids, but cannot act as a nitrogenous food in the same manner as the proteids proper. Many substances also of vegetable origin also are closely allied to these animal compounds, and are spoken of as vegetable proteids.

Proteolepas, the only known genus of the group Apoda (q.v.).

Proteomyxa, a group of the simple unicellular animals belonging to the great group of the Protozoa. Most of them live in fresh-water. The best-known members are the Monads and the Monera. They are all very simple in structure, and some appear never to have a nucleus, e.g. *Archerina*, so that they are "cytodes" and not "cells" (q.v.).

Many of the Monera resemble simple types of the "Heliozoa" (q.v.), thus *Archerina* is much like the small "Sun-animalcule" or *Actinophrys*. Many of the Monads are parasitic; thus one species of *Protomonas* lives in the fresh-water Alga *Spirogyra*, and *Colpodella* in the minute Infusorian *Chlamydomonas*, or *Gymnococcus fockei* on diatoms. One group, the *Plasmodiophoreae*, lives in plant-roots: thus *Plasmodiophora brassicae* injures the roots of various species of vegetables of the genus *Brassica*; it is the cause of the disease known as "Fingers and Toes." The members of this group, however, may be really vegetables, as they are assigned by most botanists to the Slime-Fungi or Myxomycetes. *Bursulla*, the only member of its family, lives on horse-dung. Our knowledge of the Proteomyxa is still very limited, and it is probable that when more is known the group will be broken up.

Protestant, a term applied to all those who hold the principles of the Reformation, but, as far as England is concerned, not sanctioned by Anglican usage. It was first assumed by the followers of Luther, who protested against the decree of the second Diet of Spires (1529) revoking that of the first diet (1526), by which the marriage of the clergy, the administration of the sacrament in both kinds, and various other changes had been introduced.

Proteus, the "old man of the sea," tended the seals of Poseidon or Neptune, and had the power of prophecy. This function, however, he was wont to evade the performance of by suddenly changing his shape. Hence the modern proverbial adjective formed from his name. He is variously said to have had his abode in Pharos and Carpathus. Another set of myths makes him a son of Poseidon and a king of Egypt, who receives Helen on her flight thither and restores her to Menelaüs.

Proteus, a genus of tailed Amphibians, with persistent gills, from the subterranean waters of Carniola and Dalmatia. There are two or three species. Rudimentary lungs are present; their eyes are hidden in the skin, but the animals are sensitive to light.

Prothallium, otherwise written *Prothallus*, is the gametophyte of the Pteridophyta (q.v.), i.e. that plant, generation, or stage in the life-cycle, that bears the sexual reproductive organs. It is a small thalloid body, often a mere plate of cells one cell thick, leading a short but independent life and without any trace of vascular tissue. It may, or may not, contain chlorophyll. In heterosporous forms the prothallia are reduced to mere minute appendages of the spores, and in homosporous groups they may be dioecious, bearing only antheridia or only archegonia.

Prothallus. [PROTHALLIUM.]

Protista, a term suggested by Haeckel for those organisms which cannot be definitely referred to either the animal or vegetable kingdoms. As, however, no precise limit can be placed upon its extent in either direction, its adoption would be but to double the difficulty which now is single, and thus it has not been generally adopted.

Protophyta, a provisional name for the lowest grade of plants, whether algal or fungal, in which no sexual process was known or seemed to have existed, they being unicellular bodies reproducing themselves by mere division. The group included the Cyanophyceæ and some Chlorophyceæ and Phæophyceæ among Algæ, and the Schizomycetes and Myxomycetes among Fungi.

Protoplasm—the so-called “physical basis of life”—is a substance which possesses the properties of spontaneous movement, nutrition, excretion, and reproduction, and constitutes the simplest of living organisms. It consists essentially of hydrogen, oxygen, carbon, and nitrogen, with a certain amount of sulphur, phosphorus, potassium, and sodium; other elements are usually present in addition. Its chemical composition is therefore complex, while, as it is almost impossible to get it pure from waste food products, its quantitative analysis has not been satisfactorily determined. Its essential property is its power of movement spontaneously under certain irritation. This, however, is accompanied by a necessary oxidisation of part of its constituents. To counterbalance this and keep up the supply of unoxidised material, the protoplasm has to feed; the waste products formed by the oxidisation or absorbed with the food have also to be got rid of, which is secured by the process of excretion. If the protoplasm absorbs more food than is required to supply the waste due to movements, it increases in bulk; and when the particle of protoplasm has increased so as to be inconveniently large, it subdivides and reproduction is effected. This is usually determined by the agency of a specialised part of the protoplasm known as the “nucleus” (q.v.), but certain of the Proteomyxa (q.v.) have no such structure but have the power of reproduction. The simplest method of studying the movements, etc., of protoplasm is the observation of the white corpuscles of the blood or the common fresh-water *Amœba* (q.v.), or *Proteus-Animalcule*.

Prototheria. [MAMMALS.]

Protozoa, one of the two sub-kingdoms of animals. It includes all the unicellular animals—viz. those which consist of a single cell or “cytode”; a certain fusion of cells may occur, but in such cases there is no specialisation of function, and the animal consists simply of an aggregate of individual cells all like one another. It is difficult to form any precise definition of the group; the simple statement that it includes “only all unicellular animals” is indefinite owing to the impossibility of satisfactorily defining the word “animals.” Many zoologists now include among the Protozoa many forms also claimed by the botanist [ANIMAL KINGDOM], such as Volvox, and many of the Slime Fungi or Myxomycetes. The classification of the Protozoa is as follows:—

1. Rhizopoda, including those which are provided with pseudopodia.
 - (a) Heliozoa.
 - (b) Radiolaria.
 - (c) Foraminifera.
 - (d) Amœbina.

- (e) Mycetozoa (Slime Fungi; probably Vegetable).
- (f) Labyrinthulidea.
- (g) Proteomyxa.
2. Endoparasita. Internal Parasites.
 - (a) Sporozoa or Gregarinida.
 - (b) Amœbosporidia.
 - (c) Sarcosporidia.
 - (d) Myxosporidia.
3. Plegepoda, which move by vibratile processes.
 - (a) Acinetaria.
 - (b) Infusoria.
 - (c) Mastigophora.

The Protozoa are almost universally distributed at present, occurring in the sea, fresh-waters, on land, in the air, and parasitic in both animals and plants. As they are usually minute and have no hard parts, most of the classes are not known as fossils; the Radiolaria and Foraminifera are, however, very important to geologists owing to the wealth of the fossil forms, while extinct representatives of the Infusoria are known.

Protracheata, the class of Arthropoda which includes the remarkable worm-like animal known as *Peripatus* (q.v.).

Proudhon, PIERRE JOSEPH (1809-65), was the son of a Besançon cooper. Having received a scholarship from the academy of this town for some inconsiderable philological works which he had written while working as a printer, he went to Paris and published his “*Qu'est-ce que la Propriété?*” (1840). “Property is robbery” (“*la propriété c'est le vol*”) was the conclusion at which he arrived in his book. For his “*Arrestement aux Propriétaires*,” a similar work, he was tried but acquitted. He published several works dealing with economics, and in 1848 returned to Paris to edit a paper, which was prosecuted and suppressed, and he had to leave France to escape fine and imprisonment. On his return he was confined in Ste. Pélagie, where he carried on his paper, was married, and wrote *Confessions of a Revolutionist*. Having in 1858 published *Justice in the Revolution and the Church*, he was again sentenced to imprisonment, and fled to Belgium.

Prout, SAMUEL (1783-1852), was born and educated at Plymouth, but in 1802 came to London to illustrate Britton's *Beauties of England*. In 1804 he first exhibited at the Royal Academy, and he soon became well known for his delineation of country scenes. In 1815 he was elected to the Water Colour Society, and in 1818 made a tour in Normandy. Six years later he travelled in Italy, Germany, and Bohemia. Years afterwards the results of this were seen in *Sketches in France, Italy, and Switzerland*, which raised his reputation as a painter of foreign towns to an equal height with that he had attained as an English artist by his *Views of Northern England* (1821). His great picture, *The Indiaman Ashore*, was painted in 1819.

Prout's Law. It was assumed in 1815 by the chemist Prout that all the supposed elementary substances arose out of the condensation of a primordial matter or “protyle.” This substance was supposed to be identical with hydrogen, and as each of the other atoms was formed by the

condensation of a definite number of hydrogen atoms, it followed that the atomic weights of all the elements should be integral multiples of that of hydrogen. This is what is usually meant by Prout's hypothesis or Prout's law. At first the data at the disposal of chemists were insufficient to adequately test this; but, as fresh and accurate determinations of atomic weights were made, it became evident that it could not be held as valid. In spite of some alterations made to account for certain discrepancies—such as halving the hydrogen atom—the law at present is not sufficiently supported, although the number of elements whose atomic weights do approach very nearly to integral values is a remarkable fact. [ATOMIC THEORY.]

Provence, an old province of the S.E. of France, now divided into the departments of Basses-Alpes, Bouches-du-Rhone, Var, and part of Vaucluse. It formed the Provincia of the Romans, and at the disruption of the Empire fell into the hands, first of the Visigoths, next of the Ostrogoths, and was then conquered by Clovis. In 879 Boson, the governor, caused himself to be elected king, and founded a dynasty which lasted until 1481, when Louis XI. united the territory to France. Possessing for the most part a fertile soil and enjoying a fine climate, Provence produces almost all the vegetables and fruits of Europe. The mineral wealth is considerable, but remains undeveloped. The Provençal troubadours exercised a considerable influence on French poetry.

Proverbs, BOOK OF, a canonical book of the Old Testament, the full title of which is "The Proverbs of Solomon." The Hebrew *mashal* (rendered by *paroimia* in the Septuagint and *proverbium* in the Vulgate) differed from the ordinary "proverb" in that its most essential feature was not point or humour but the conveyance of religious and moral instruction. At first it probably presented in a terse and graphic manner some analogy between the physical world or man's social surroundings and the laws of his inner life (*cf.* Prov. xxv. 26, "A trampled fountain and a fouled spring is the righteous man who hath given way before the wicked"). In a later and more artificial age it became customary to throw each maxim into the form of a distich, which was frequently antithetic in character (*cf.* Prov. x. 1, "A wise son maketh a glad father, but a foolish son is the heaviness of his mother"). Like all collections of proverbs, the *meshley* were not the product of a single mind, but the gradual growth of ages. Internal evidence shows that the book comprises at least seven distinct portions, but it is impossible to determine with anything like certainty the comparative age of these or the circumstances of their composition.

Providence, jointly with Newport the capital of Rhode Island, United States of America, stands on both banks of Providence river, at the head of Narragansett Bay, 43 miles S.W. of Boston. Founded by Roger Williams in 1638, it flourished first as a centre of foreign trade, but is now dependent chiefly on manufacturing industries, such as cotton- and wool-spinning, iron-founding, and

the manufacture of engines, tools, and jewellery. The excellent harbour still commands a large coasting traffic. The State House dates from 1762, and the City Hall is one of the finest buildings in New England. A spacious park commemorates the founder and surrounds a large lake.

Provincial, a religious superior who has the superintendence of all the brethren in a particular district known as a province.

Provosts, a title derived from the Latin *præpositus*, "placed at the head." Three main uses may be distinguished:—(1) In Austria, Bavaria, Prussia, and England it denotes the head of a cathedral chapter of the Roman Catholic Church, and the term is applied in the same way in the Episcopal Church of Scotland. In the Protestant Church of Germany it is used of the minister of a church to which other churches are subordinate. (2) The heads of three colleges in Oxford, one in Cambridge, and Eton College bear the title. (3) The provost of a Scotch burgh corresponds to the English mayor, the full title being Lord Provost in Edinburgh, Glasgow, Perth, and Aberdeen.

Prudentius, AURELIUS CLEMENS, the Christian Latin poet, was born in 348 at some town in Spain. He adopted the profession of a lawyer and became a judge, and he afterwards held a high court appointment at Rome, where he became tired of worldly affairs, and, turning to religion, expressed his thought in several hymns, philosophical anti-pagan poems (*Contra Symmachum*), fourteen poems in honour of saints, and the *Diptychon*, a hexameter poem on Scriptural history. In his *Prefatio* he gives details of his life up to 405, and a catalogue of his works.

Prurigo, a skin affection attended with violent itching.

Prussia (German, *Preussen*), a kingdom of Europe, and the chief state of the German Empire, is bounded N. by the Baltic, Denmark, and the North Sea, S. by Austria and Saxony, Bavaria, Hesse-Darmstadt, and Alsace-Lorraine, E. by Russia, and W. by Belgium and the Netherlands. It has an area of 137,066 square miles, being for the most part level except in the neighbourhood of the Rhine and the Moselle, the central district of the Harz Mountains, and the Saxon border-land. Besides the two rivers above-named, which drain with their tributaries the western portion of the kingdom, there are also the Elbe, the Oder, and the Niemen, whilst the Vistula receives some of the waters in the extreme east, where lakes are numerous. The coast-line of 500 miles affords few good harbours—Königsberg, Dantzic, Stettin, Swinemünde, Kiel, and Hamburg, with the river-port of Bremen, being the most important. The soil on the whole is fertile, though there are large sandy tracts in the north, and vast forests scattered over the central and eastern regions. Owing to the diversity of climates, the agricultural products are varied, the vine, maize, hops, and fruits of all kinds being abundant in the south and west, whilst the colder districts yield cereals, potatoes, linseed,

hemp, and flax. Coal and iron are worked successfully, and almost all metals except gold and silver exist in considerable quantity, whilst mineral springs are a large source of wealth. Manufactures of linen, cotton, woollen, and silk goods flourish at various industrial centres, and the iron and steel works rival, if they do not surpass, those of England. Of late years, too, artistic industries have made great strides. The government is a constitutional monarchy, with two legislative chambers—viz. the Herrenhaus, answering to our House of Lords (but not wholly hereditary), and the Abgeordnetenhaus, or Chamber of Deputies, elected by a system of indirect suffrage so devised as to give great weight to property, while the present distribution of seats tells strongly in favour of the landed interest. The sovereign, however, exercises very wide prerogatives. To the Bundesrath of the Empire Prussia sends seventeen members out of fifty-nine, and contributes two-thirds of the constituents of the Reichstag. The kingdom is divided for administrative purposes into thirteen provinces. Berlin is the capital, and among other important cities are Cologne, Frankfurt-on-the-Main, Magdeburg, Breslau, Hanover, Elberfeld, and Aachen. Primary education is compulsory and is carefully enforced. There are ten universities, most of which enjoy high repute. Religious liberty prevails in the main, though legislation has occasionally been directed against Roman Catholics, who constitute a third of the population, the rest being Protestants, with a large Jewish element. The railway system is well developed, and about half the lines are owned by the State.

Prussians, OLD PRUSSIANS, or PRUCZI, the western division of the Lithuanians (q.v.), who originally occupied the region between the Vistula and Niemen—that is, part of West and the whole of East Prussia. As a separate nationality these Prussians became extinct or absorbed in the surrounding German populations about 250 years ago. Of their Lithuanian dialect, which died out towards the middle of the 17th century, nothing survives except a vocabulary of over 800 words dating from the beginning of the 15th century. and a translation of the German catechism published in 1561. Prussian was of more archaic type than Lettic, and even preserved some forms older than those of Lithuanian itself.

Prussian Blue. When solutions of a *ferrie* salt and yellow prussiate of potash are mixed together, a heavy dark-blue precipitate is formed known as *Prussian blue*, and employed largely as a pigment. Before being used for this purpose, the precipitate is washed well with water and a dilute acid. It has the composition represented by the formula $\text{Fe}_7(\text{CN})_{18}$, but its exact nature has yet to be determined. It dissolves readily in oxalic acid, yielding a liquid employed as a blue ink. A compound obtained from *red prussiate* and a *ferrous* salt is very similar if not identical, and is known as *Turnbull's blue*.

Prussiate of Potash. Two salts are known as prussiates of potash—viz. the *yellow prussiate*

and the *red prussiate*. The former of these is a salt of the composition $\text{K}_4\text{FeC}_6\text{N}_6$, which forms fine large yellow crystals soluble in water. It is obtained by heating organic nitrogenous matter, such as horns, hoofs, etc., together with crude potash and iron filings, and extracting the fused mass with water. It is important chemically, as it is the source from which prussic acid and almost all the cyanogen compounds are ultimately produced. Although classified as a poison in pharmacy, it is not poisonous. It may be readily recognised by the fact that it gives in solution a fine blue precipitate with *ferrie* salts. It is employed medicinally to a slight extent, acting as a laxative. *Red prussiate* is obtained from the preceding compound by passing chlorine through its solution. It forms fine ruby-red crystals, and has the composition represented by $\text{K}_3\text{FeC}_6\text{N}_6$. It is soluble in water, forming a brownish-green solution, which, with *ferrous* salts, yields a dark-blue precipitate. Besides its use in pure chemistry, it is employed for the production of a photographic paper used largely by engineers, etc., for giving tracing of line drawings.

Prussic Acid, or HYDROCYANIC ACID, consists chemically of hydrogen cyanide, HCN, and may be prepared by heating a metallic cyanide with an acid. It is also formed when an electric discharge is passed through a mixture of cyanogen and hydrogen or of acetylene and nitrogen. As in this latter case the acetylene can be produced by the direct union of its components, it follows that prussic acid can be formed by direct synthesis from its elements. The equation for this formation is $\text{C}_2\text{H}_2 + \text{N}_2 = 2\text{HCN}$. It is also produced by the fermentation of a certain vegetable product—*amygdalin* [GLUCOSIDE]—contained in laurel leaves, bitter almonds, cherry-stones, and other sources. If pure, it is a colourless liquid which boils at 26.5°C ., and may be solidified by cooling to -15°C . It has a specific gravity of about .7. It is inflammable, burning with a characteristic purple flame. Its odour if diluted is peculiar and irritating. It is soluble in water and most solvents. It is exceedingly poisonous. Nausea, convulsions, and rapid insensibility are the usual symptoms. Chemical antidotes are of little avail, the only satisfactory treatment being the evacuation of the contents of the stomach, if that is possible, and the application of the cold douche to the neck and spine.

Prynne, WILLIAM (1600–69), Puritan pamphleteer, entered at Lincoln's Inn in 1620, and soon became known for his controversial and legal writings. In 1632 he published *Histriomastix* (*The Actor's Seourge*), reflecting on the immorality of the stage. For words contained in this supposed to refer to the queen he was degraded from his profession by the Star Chamber, fined, pilloried, and mutilated. For attacking the bishops in *News from Ipswich* (1637) he was condemned to imprisonment for life, but both his sentences were declared illegal by the Long Parliament. Prynne, however, subsequently opposed the king's trial, and was one of the "purged." At the Restoration he was made Keeper of the Tower Records

Psalmanazar, GEORGE, was born probably in the south of France about 1680. After wandering about the Continent in various characters, he came to England in the early years of the 18th century. He pretended to be a Formosan, and wrote a book on that country in 1704, and translated the Church Catechism into what was supposed to be that language. He was believed in by Compton, Bishop of London, and Dr. Johnson, but was certainly a thorough impostor. After playing many parts, he died an old man in London in 1763. He was a great opium-eater.

Psalms, THE BOOK OF, one of the books of the Bible, containing 150 Psalms, many of which are traditionally attributed to David. A number are supposed to have been written at the time of the exile or later.

Pseudaxonia, the order of Alcyonarian corals, of which the "red coral" of commerce (*Corallium rubrum*) is the best-known representative. The order is characterised by the presence of a rod-like, branching skeleton, which is surrounded by the fleshy parts of the animals which compose the colony. The skeleton is therefore said to be sclerobasic: it consists in *Corallium* of fused calcareous spicules; in other groups these spicules are less abundant and occur either scattered through a horny axis (as in the Sclerogorgiacea), or the skeleton consists of joints formed of spicules alternating with others formed of horny material (as in *Melithaea*). The oldest representatives of the order are some Jurassic species of *Corallium*.

Pseudocœle, the name applied to the functional body cavity in the higher animals: it is so called because it is due to the formation of spaces in the tissues and is not connected with the primitive cavity in the embryo. [CÆLOME.]

Pseudomorphs are minerals occurring in forms characteristic of some other species. They have generally rounded angles and dull surfaces. Pseudomorphs may be grouped, according to their mode of origin, into four classes:—

1. *Encrustation pseudomorphs*, or *epimorphs*, where one mineral encrusts another, which is subsequently dissolved and may be replaced.

2. *Alteration pseudomorphs*, formed by gradual chemical change. They arise either (1) from loss of a constituent (*katogenic*), as copper from cuprite (CuO); or (2) from gain of a constituent (*anogenic*), as malachite ($\text{CuCO}_3 + \text{CuH}_2\text{O}_2$) from cuprite, or anglesite (PbSO_4) from galena (PbS); or (3) from exchange of constituents, as galena from pyromorphite ($3\text{Pb}_3\text{P}_2\text{O}_8 + \text{PbCl}$).

3. *Replacement or Substitution pseudomorphs*, where one substance is removed and an altogether distinct substance substituted for it, as hæmatite (Fe_2O_3) for calcite (CaCO_3).

4. *Paramorphic pseudomorphs*, or *paramorphs*, where one dimorphic condition of a chemical substance replaces another, i.e. where the molecules have been rearranged without change of composition, as calcite from aragonite.

Fossils may be considered as calcite, opal, fluor, marcasite, or other mineral, pseudomorphous after animal or vegetable matter. Pseudomorphism, having often occurred on a large scale, is of the utmost importance in the study of rocks.

Pseudonym (Greek *pseudōs*, "false," and

onoma, "name"), a fictitious name adopted by an author to conceal his personality. "George Eliot" (Marian Evans), "Christopher North" (John Wilson), and "Boz" (Charles Dickens) are familiar examples. So, too, the painter Hablot K. Browne assumed the pseudonym of "Phiz."

Pseudopodia, the blunt, thick, irregular processes from the protoplasm which forms the body substance of many Protozoa, especially those belonging to the Rhizopoda. [AMÆBA.]

Pseudoscorpionidæ, a group of Arachnida (q.v.) which have a long, clawed pair of appendages arising from the head, which give them somewhat the aspect of small scorpions. The abdomen, however, is very different, as in these it is broad and flat throughout, and has no narrow posterior part (metasoma). The best-known member is the "book scorpion" or *Chelifer*.

Pshav, a Caucasian people forming a distinct branch of the Georgian family, whose territory comprises the upland valleys of the Aragva river and some of the head-waters of the Kûr, in the government of Tiflis. The Pshavs, who numbered about 7,000 in 1890, are still a half-savage people, living in small tribal or family groups, holding their lands in common, preserving traces of the old matriarchal system, speaking an archaic form of Georgian, and, although nominally Christians, addicted to many pagan practices. (Kovalevsky, *Les Pchaves*, Moscow, 1888.)

Psocidæ, a family of Pseudoneuroptera, generally known as the "book flies." They are wingless insects, usually about $\frac{1}{10}$ of an inch in length, and live among old books and papers. *Atropos pulsatoria* is the common English species.

Psoriasis, a skin affection in which congested areas, which subsequently assume a scaly form of desquamation, develop on the skin. The eruption usually appears on the back of the arm or the front of the legs, but may affect other parts of the body. It is apt to recur.

Psyche, the heroine of a Greek myth dealing with the love of the soul (*psuchē*), was beloved by Eros (Cupid). They only met at night, and the mortal maiden was warned by the god not to try to discover who he was. At last, however, curiosity got the better of her, and she lit a lamp and looked at him while asleep. Eros, awaked by a drop of hot oil which fell on him, immediately vanished; and it was not till after long wanderings that Psyche was again united to the god in the palace of Aphrodite, where the jealous Queen of Love had kept her for a time in slavery.

Psychidæ, a family of moths in which the females are wingless and limbless, and never quit the tubes formed by the larvæ.

Psychology. Psychology may be defined as the "science of mind." It properly denotes that part of philosophy which deals with the soul (Greek, *psuchē*); but the soul is a mysterious

entity, the nature of which eludes scientific inquiry. The old "rational" psychology started with the assumption that mind is a peculiar property of the individual, and was thus hampered at the outset with associations inseparable from the empirical Ego. For "empirical" or "experimental" psychology on the other hand, mind is merely a congeries of complex phenomena, and the idea of personality is itself a mental phenomenon, the origin of which requires explanation. Psychology claims to be a science because, in tracing the development of mental life, it proceeds on the same assumptions and makes use of the same methods as the physical sciences. When it abandons observation and experiment and falls back on *à priori* reasoning, it loses its scientific character. A more exact notion of its scope may be gained by distinguishing it from the "disciplines," to which, on one side or another, it has the closest affinity. (1) Metaphysic seeks to evolve the whole system of the universe from some groundwork or fundamental principle beyond the reach of experience proper. Psychology, on the other hand, makes no attempt to pass beyond the limits of experience. In the language of philosophy, metaphysic is concerned with mind in its "noumenal," psychology in its "phenomenal" aspect. (2) Logic discusses the validity of mental processes—shows the principles to which they must conform if their results are to hold good for all minds in a normal condition. But psychology confines its attention to the mental processes themselves. (3) Physiology treats of the animal organism, including those bodily functions which are closely associated with mental activity. The line between the two is, however, very sharply drawn, so that it is impossible to interpret the one in terms of the other, or even to establish a causal relation between them. Yet the interaction of mind and body as mutual cause and effect is supposed to be a matter of common experience, and it is assumed in psychology as the most convenient working hypothesis.

The only valid distinction between mental and physical phenomena is that the latter are cognised as existing in space, whereas the spatial element is absent from mind, or exists only in the form of represented extension. But space-relations are involved in all objective truth, so that in a sphere where the conception is precluded, each individual would seem to be confined to his own experience. If the mental phenomena themselves furnished the sole clue for ascertaining the laws by which they are regulated, psychological inquiry would indeed be limited to the examination of our own minds; but we know that every form of mental activity has its physical counterpart in certain bodily changes. Ordinary observation supplies rough generalisations regarding the workings of other minds, and by means of the data furnished by physiology these can be reduced to a scientific form. From physiology we learn that we have a nervous system consisting of a central mass composed of the brain and spinal cord, and a multitude of afferent (incarrying) and efferent (outcarrying) nerves, which convey activity to and from the central portion respectively. We know further

that each of the five "special" senses has its own system of afferent and efferent nerves, connected at the extremity farthest from the brain with an external sense-organ, through which the brain communicates with the outer world. A sensation is preceded by a stimulation of the peripheral surface of a nerve, and in the more complex of the "nerve-centres," where a multitude of nerves unite, a co-ordination of sensations is supposed to take place, resulting in higher forms of thought. The fact that the efferent nerves, which control the muscles, act in harmony with the afferent nerves is important in connection with the development of the will. It will thus be seen that psychology rests on a twofold foundation—introspection and physiological inquiry.

Mind embraces the emotional and active as well as the intellectual portions of consciousness. The old psychology accepted the popular fallacy that man is endowed with "faculties," usually distinguished as intellect, feeling, and will. But these "faculties" must be reckoned among the fictions which the mind naturally creates in its endeavour to render the universe more intelligible. Assumptions regarding the subjective basis of mind are out of place in science, and moreover in the simplest act of consciousness discrimination (which is thought), feeling, and the impulse to act are inextricably woven together. Nevertheless, the distinction between the three classes of mental phenomena is useful or rather essential; it is based on a real difference of which the mind is conscious, and some preliminary abstraction and classification are indispensable. The analysis of mental states into elements which never actually occur in isolation may be carried much farther in each of the three spheres. The primary distinction here made is that between Presentation and Representation. Presentation may be said to give us sensations; Representation, images or ideas, but in fact even an apparently simple sensation contains representative elements. A presentation is an immediate fact of consciousness, the genesis of which is attributed to external agencies, and not to a mental process, voluntary or involuntary, of the subject. The measure of each person's control over his own presentations need not be discussed here; it is sufficient to observe that the feeling of "reality" attaching to them always rests on the belief that they are forced in upon our minds from some external source. On the other hand the dim and blurred copy of a presentation called a representation arises in our minds in connection with our own past or anticipated experience. Sensation, perception, conception, judgment, reasoning, form a scale in which presentation soon disappears and the representative elements become more numerous and complex. A percept is a group of (presented and represented) sensations which are supposed to correspond to so many "qualities" or "attributes" inherent in some external object or substance; an unsophisticated person might call it an immediate mental reproduction of the object, but this notion cannot, of course, be justified on philosophic grounds. A concept is an image with

properties common to several percepts or ideas, each of which has attributes not contained in the concept. In language concepts are represented by common and abstract names. A judgment is a comparison of percepts or concepts, or of a percept with a concept; its equivalent in language is the proposition. Apparently there is no difference in kind between a judgment and an intuition of sense, the only distinction being that in the former higher forms of thought are brought together and the self-conscious element is more distinctly present. A train of reasoning, the simplest example of which is the syllogism, is a complex process in which several judgments combine so as to form a new judgment. In like manner feelings are classified according to the degree of their complexity, and mind on its active side is traced through many stages from reflex action to a sustained tension of the will manifested in a complicated series of actions directed towards some common end.

Our survey has hitherto been statical rather than dynamical; it will now be well to look more closely into the mechanism of mind, especially on the intellectual side. The attitude of the subject engaged in building up the fabric of its own experience is call Attention. Our consciousness at any moment consists of a vaguely-diffused mass, portions of which present themselves with great distinctness while others are but dimly realised. Before any portion of this fleeting consciousness can become a permanent mental possession, it must acquire a certain degree of precision and clearness, so as to be—at least in appearance—separable from the adjoining mass. We are then said to attend to it. Whatever an act of attention may be in itself—whether it be a modification of nerve centres or a step in the realisation of the Ego—its importance for psychology is that it involves a consciousness either of the difference or the similarity of two phenomena (or rather, in all actual acts of attention, of both together). To this intuition need only be added the power of retaining or recalling impressions (ideation or representation), and the mind is furnished with all that it needs for carrying out the most recondite and complex processes. A sensation must be discriminated from others before it can be recalled; attention to the features common to several percepts is necessary for the concept; to judge and to reason are only to detect points of resemblance and diversity on a more extended scale. The most plausible view of ideation seems to be that the mind does not entirely lose its forgotten impressions; they continue to form part of its integral substance, but sink below the level of consciousness to a “sub-conscious” region, from which they may be recalled by some favourable train of thought. This view gives a new meaning to the “Laws of Association” formulated by the first English scientific psychologists. Of these the most important was the Law of Contiguity, according to which any mental experience has the power of reviving another with which it has been frequently conjoined. The sight of a lump of sugar will probably recall the idea of a sweet taste. Those psychologists who take a purely physical view of

mind hold that the recurrence of an impression in the form of an idea is due merely to the irritation of the nerve region originally affected.

Psychologists frequently disclaim any metaphysical bias, but it must be admitted that their explanations are usually more in accordance with empirical than with *à priori* views. This is well illustrated in the account commonly given of the processes involved in perception. The attribute of resistance, which is one of the chief elements in our notion of matter, is derived from the muscular feeling of expended energy. In like manner the notion of extension or space and the localisation of objects therein are traced to a complicated series of movements (involving muscular activity) accompanied by sensations of touch. Every school would acknowledge that there is a basis of truth in this exposition, but that does not necessarily involve assent to the manner in which it is put forward.

Whatever progress psychology may make, it is probable that a vast field of mental activity will always lie outside the range of experiment and external observation. In this region introspection must remain the only method of discovering mental laws. In so far as the theories of psychologists are found to tally with everyone's inner experience, they certainly acquire some degree of objective validity. But we are here confronted with a further difficulty. The mind turned inwards upon itself can never gain a complete survey of its own contents; in the very act of observing his present condition the thinker introduces a new and disturbing force, and, whatever efforts he may make to eliminate the personal factor, self-consciousness must always remain an unresolved element in the background. For this reason, among others, psychologists are disposed to abandon the introspective field, and seek for the verification and amplification of the laws already formulated concerning mental action in an enlarged study of its physical accompaniments. To the “psycho-physical” experiments of Weber, Fechner, and Wundt, as well as others of more recent date in America, we are indebted for much interesting information regarding the workings of the mind. An important class of experiments is that relating to reaction-time, *i.e.* the time which passes before muscular activity manifests itself in response to a sense-stimulus. Very precise results have been obtained, the time, of course, varying with personal differences and the complexity of the processes involved.

Psychrometer is another name for Mason's wet and dry bulb hygrometer (q.v.), and is an instrument for measuring the tension of aqueous vapour in the air.

Ptarmigan (*Lagopus*), a genus of game birds of the Grouse family, having the legs feathered to the toes. There are several species, natives of the northern parts of both hemispheres. In winter, with one exception (the Red Grouse), they assume white plumage. The Common Ptarmigan (*L. mutus*) is found in North and Central Scotland, the Orkneys and the Hebrides, and in the mountainous parts of Northern Europe. The male is about fifteen inches

long; the summer dress is greyish-brown; the head, shoulders, and breast being blackish, while



PTARMIGAN (*Lagopus mutus*).

the under surface and wings are white. The old birds eat alpine berries, seeds, and young shoots, but the young ones are fed chiefly on insects. The flesh of Ptarmigan is much esteemed for the table. [GROUSE.]

Pteridophyta (formerly termed Vascular Cryptogams), a sub-kingdom of plants including three classes, the Filicinæ, Equisetinæ, and Lycopodinæ, *i.e.* ferns, horsetails, and club-mosses. They have a well-marked alternation of generations (q.v.), the sporophyte being the more conspicuous stage. It is generally differentiated into root, stem, and leaf, and contains vascular tissue. It is formed from the oospore (q.v.), but part of the embryo forms an embryonic absorbent organ, the *foot* or *suspensor* (q.v.). The primary root, if present, does not persist. The stem is generally short and unbranched in Filicinæ; elongated and much branched in the other classes. The leaves are relatively large, and commonly act also as sporophylls in Filicinæ; and are minute and of two distinct kinds, foliage-leaves and sporophylls, in the other classes. Root, stem, and leaf have commonly an apical cell in Filicinæ and Equisetinæ, but a group of apical meristem in Lycopodinæ. The vascular bundles are generally closed and scalariform thickening is characteristic. Important classificatory characters are the spores being all alike (*homosporous*), or male and female (*heterosporous*), and the sporangium originating from one cell (*leptosporangiate*), or from a group (*eusporangiate*). The gametophyte or *prothallium* (q.v.) in the homosporous groups generally bears both antheridia and archegonia. The former on bursting liberate spiral antherozoids, with many cilia in Filicinæ and Equisetinæ, but with two only in Lycopodinæ. These swim about in drops of rain or dew until they are attracted to the short-necked archegonia by an excretion of malic acid. Among ferns, both apogamy (q.v.) and apospory (q.v.) occur, thus destroying any strict alternation of generations. The most recent classification, that of Professor Vines, is as follows:—

Class—FILICINÆ.

Sub-Class—*Homosporææ*.

Section—*Eusporangiatæ*.

Order—*Ophioglossaceæ*.

„ *Marattiaceæ*.

Section—*Leptosporangiatæ*.

Most ferns.

Sub-Class—*Heterosporææ*.

Section—*Eusporangiatæ*.

Order—*Isoëtaceæ*.

Section—*Leptosporangiatæ*.

Order—*Salviniaceæ*.

„ *Marsileaceæ*.

Class—EQUISETINÆ.

Order—*Equisetaceæ*.

Class—LYCOPODINÆ.

Sub-Class—*Homosporææ*.

Order—*Lycopodiaceæ*, etc.

Sub-Class—*Heterosporææ*.

Order—*Selaginellaceæ*.

Pterobranchia, a group of animals closely allied to the Bryozoa (q.v.), but the exact systematic value of which is uncertain. It is, however, probably most closely associated with the Entoprocta (q.v.). Only two genera are known, and these are very different in structure and habit. The better known is *Rhabdopleura*, which has been dredged off the coasts of Norway and Scotland, and *Cephalodiscus*, which lives in the seas of Patagonia. The former occurs as branching colonies, but the latter is simple. Their affinities to the Bryozoa are shown by the possession of an epistome and the flexure of the intestine.

Pterodactyl, the general name applied to all the winged reptiles of the Secondary rocks. Fourteen genera, including 86 species, are now recognised, varying in size from that of a sparrow to that of an albatross. They had in most cases teeth, but sometimes also a horny beak; a more or less elongated lizard-like tail; and an enormously elongated outer digit or wing-finger to the forelimbs. This supported an expansion of the integument, resembling that in the bats, which may have extended to the hind-limbs and tail. There is no probability of their having had feathers. The pterodactyls range in geological time from the Trias to the Upper Chalk. Many large forms have been found in the Cretaceous rocks of Kansas; but the longest-known and best-preserved are from the Solenhofen lithographic stone of Bavaria, Kimmeridgian in age.

Pteropoda, a class of Mollusca which live in great numbers at the surface of the ocean far from land in all parts of the world. They have heads, and thus belong to the branch of Mollusca known as Glossophora. They are bilaterally symmetrical, and thus have been regarded as allied to the Cephalopoda; thus Professor Ray Lankester groups them as the Siphonophora, but there is little doubt that this bilateral symmetry has been reacquired, while it is probable that the lateral wing-like processes (or epipodia) are not homologous with the arms of the Cephalopoda. The larvæ are always provided with a shell, but in the adult there is one, only in those belonging to the order Thecosomata. This, however, does not represent the larval shell, but one secondarily acquired by all Pteropods; both shells are thrown off in the order Gymnosomata and one family of the other order, *viz.* the

Cymbulidæ, in which a third shell is formed; both remain in *Styliola*, and the larval shell only in the family *Hyaleidæ*. The Pteropods are small animals, and are usually found only at some distance from land, but they have been found on the Scotch coast, as in St. Andrew's Bay; they occur in such enormous shoals that, in spite of their small size, they form a leading part in the food of whales. There are two orders—the Thecosomata, the members of which have a shell, and the Gymnosomata, in which they are shell-less. The group is one of great antiquity, though much doubt arises as to whether the great *Conularia*, *Theca*, etc., of the Cambrian rocks are really correctly referred to the Pteropods. Another interesting fossil that has been assigned to this order is *Tentaculites* from the Silurian, but this is unquestionably a worm.

Pterygogenea, the subdivision of Insects, including all those which have wings, or which, if wingless, such as the Fleas and Bird-lice, are descendants of winged forms. It thus includes all insects except the two members of the two small orders, the Collembola (q.v.) and Thysanura (q.v.), which are grouped together as the *Apterygogenea*.

Ptilocerque (*Ptilocercus lowei*), an elegant little shrew from Borneo. The tail, near the end, has long hairs on each side like a feather.

Ptolemaic System, so called from Ptolemy (q.v.), was the theory of the universe which obtained until the 16th century, when that of Copernicus took its place. The main idea was that the earth was stationary, and that all the heavenly bodies rotated round it in circles, and at a uniform rate. [COPERNICUS.]

Ptolemy (CLAUDIUS PTOLEMÆUS), the astronomer and geographer, lived in Egypt in the 2nd century after Christ. His works were textbooks throughout the Middle Ages. His astronomical writings, from which was gathered the Ptolemaic System, consisted of the *Almagest* (*The Great Work*), or, according to its Greek title, *The Great System of Astronomy*; the work which contains the *Tetrabublos Syntaxis* and the *Karpos* or *Book of a Hundred Aphorisms*; and a *Treatise on the Phenomena of Fixed Stars*. The *Geographia*, a work in eight books, illustrated by a map of the world and twenty-six other maps, was founded on the labours of a certain Marinus of Tyre. Ptolemy took Ferro in the Canaries as the westernmost part of the world from which to calculate his longitudes, and placed it nearly 7° too far east. Latitudes were reckoned from Rhodes.

Ptoxis, drooping of the upper eyelid, is usually due to paralysis of the third cranial nerve, which supplies the muscle whose function it is to raise the lid.

Ptyalin, a proteid substance existing in the saliva of the mouth. In its composition it closely resembles *mucin* (q.v.). It is soluble in water, and induces a fermentive change in starchy matters whereby they pass into soluble sugars. Hence it plays an important part in digestion in aiding the

assimilation of the otherwise insoluble starch and allied compounds. [DIGESTION.]

Puberty, the age at which the functions of the reproductive organs first become developed. It is marked in girls by the commencement of the menstrual flow; in boys by the breaking of the voice and the appearance of hair on the face. The phenomena of puberty are first manifested, as a rule, from the thirteenth to the seventeenth year, and earlier, as a rule, in females than in males.

Publicani, in the days of the Roman Republic, were a class who farmed the public taxes, consisting chiefly of tolls, tithes, mining and salt duties, harbour duties, and the rents of the public pastures. The office was put up to auction by the censors, and was held for a period of five years. As the security required exceeded the wealth of any private citizen, companies (*societates*) were formed in which the speculators took shares. The *publicani*, who generally belonged to the equestrian order, often amassed great wealth. Under the Empire they were to some extent superseded by state functionaries, but always retained the collection of the customs. The "publicans" of the New Testament were also farmers of the taxes, but in a much humbler way of business, and, as Jews collecting tribute for the foreigner, were regarded by their fellow-countrymen as traitors and outcasts.

Puccinotti, FRANCESCO (1794–1872), a great medical writer, was born at Urbino and studied at Pavia and Rome. He lost his professorship of pathology at Macerata on account of his liberal opinions, but in 1838 received the chair of medical jurisprudence at Pisa. He died at Florence, and was buried in Santa Croce. His greatest work was the *Storia Della Medicina*, but he was also author of valuable treatises on malarial fever, cholera, rice-disease, and other subjects. He was also a distinguished classical scholar.

Puck occurs in *Piers Plowman* as a name for the Devil. In Spenser (*Epithalamion*, 321) and in Burton (*Anatomy of Melancholy*, p. 126, ed. 1881) it is employed as a general term for an evil or mischievous sprite. It was also used to designate a brownie (q.v.). The familiar notion of Puck is taken from the creation of Shakespeare in *A Midsummer Night's Dream*, where (act ii. scene i.), in the colloquy with the Fairy, Puck's nature and character are clearly shown.

Puddingstone, or CONGLOMERATE, a consolidated shingle, consisting of rounded fragments or pebbles, generally siliceous, cemented together either by carbonate of lime, silica, iron-oxide, or other material. The formation of such a bed may indicate a considerable lapse of time, since a rock must be consolidated and exposed to denudation before pebbles can be formed from it, and then the pebbles require to be cemented. The name puddingstone is specially applied to a conglomerate in the Woolwich Beds (q.v.) of Hertfordshire, consisting of black (raisin-like) flint pebbles in a brown ochreous (pudding-like) cement. The unequal

hardness of the two materials caused this rock to be used for handmills or *querns*.

Puddling, a process for the conversion of cast-iron into wrought-iron. The cast-iron is first purified by a process known as *refining*, and is then heated strongly in a reverberatory furnace, the mass being thoroughly stirred until it reaches a semi-pasty condition. During the process some oxide is formed upon the surface, which during the incorporation with the rest of the mass by stirring, oxidises some of the carbon of the cast-iron, producing oxides of carbon and purer iron. [IRON.]

Puebla, or LA PUEBLA DE LOS ANGELES, capital of the state of Puebla, Mexico, stands on a wide, fertile plateau, 7,200 feet above the sea, at a distance of 76 miles S.E. from Mexico. Founded in 1533, it stands third in rank among South American cities, and, owing to its position as a railway centre, it maintains its importance. The cathedral dates from 1552, though not completed for a century. The chief manufactures are cotton and woollen goods, leather, pottery, and soap. In 1863 the place was besieged and stormed by the French. The state of Puebla extends over some 12,000 square miles, being for the most part mountainous, but the plains bear rich crops of wheat, maize, and fruit. It contains the celebrated volcanic peak of Popocatepetl.

Pueblo, a county and its capital in Colorado, United States of America. The former has an area of 2,200 square miles, almost in the centre of the state, and is traversed by the Arkansas river, on the east bank of which the capital stands. A railway connects the city with Denver, and so with the Central Pacific line.

Pueblos (PUEBLO INDIANS), North American Indians of Arizona and New Mexico, so called because they occupy pueblos, or permanent agricultural settlements, where the whole community dwells in a single communal building, the so-called *casa grande* ("big house"), large enough to accommodate scores of families, and constructed like a fortress, with no outer doors, and accessible only from the top of the enclosing walls, which are scaled by means of ladders. Four distinct groups: (1) *Moqui* or *Tusayan*, a branch of the Shoshonean (Snake) family, with seven pueblos, all east of the Colorado Chiquito, Arizona; population (1890), 1,996. (2) *Keresan*, speaking a stock language, with 17 pueblos on the Upper Rio Grande and its affluents, New Mexico; population, 3,560. (3) *Tañoan* (stock language), with 14 pueblos, on the Rio Grande between lat. 33° and 36° N.; population, 3,237. (4) *Zuñian* (stock language), with one pueblo, New Mexico, lat. 35° N., near Arizona frontier; population 1,613; total Pueblo Indians (1890), 10,406. The Pueblos have never been disturbed in the possession of their settlements, and they consequently represent the primitive sedentary peoples of this region, surrounded by nomad Apache and other wild tribes, and with a culture intermediate between those of the Mound-builders of the Mississippi basin and of the Nahuas of the Mexican plateau. Some of the *casas grandes*, all of which are solid stone structures, resemble the

wooden "long houses" of the Iroquois, while others seem to be a development of the habitations of the *Cliff-dwellers* in the cañons of the Colorado and other western rivers.

Puerperal Fever, a febrile disease which sometimes occurs in women, manifesting itself between the third and the twelfth day after child-birth, and which is due to the entrance of poisonous or septic material into the blood. Before the recognition of the importance of antiseptic methods and scrupulous cleanliness in dealing with raw and wounded surfaces this disease wrought great havoc, particularly in lying-in hospitals. It is now, however, a malady of much more rare occurrence than in former days.

Puerperal Insanity. Three forms of insanity are met with in connection with child-bearing. If the mental disturbance occurs during pregnancy, it usually assumes the form of melancholia. If it affects the patient shortly after child-birth, it generally presents itself in the form of what is called puerperal mania; and lastly there is the insanity of lactation, which occurs occasionally in association with exhaustion arising from suckling. These forms of insanity are generally met with in subjects who have a hereditary tendency to mental disturbance, and recovery is the rule; but there is a tendency to relapse in connection with subsequent labours.

Puerto Cabello, a fortified seaport in Venezuela, 22 miles N.W. of the capital and occupying a peninsula in the Gulf of Taiste. The harbour is safe and spacious. Coffee, cocoa, hides, bark, indigo, woods, and cotton are exported, and there are some local industries.

Puerto de Santa Maria, or EL PUERTO, a port of Spain in the province of Cadiz, seven miles N.E. of that city, close to the mouth of the Guadalete. It is a well-built town with fine public promenades. As a place for the storing and exporting of Spanish wine it ranks next to Xeres, and it carries on a considerable trade in other produce, possessing also a few local industries.

Puff-Adder (*Clotho arietans*), a very venomous South African viper, which, when irritated, puffs out the anterior part of the body. It lies half-buried in sand, and is often trodden on, with terrible consequences, before it is noticed. The body is thick, and the length from four to five feet.

Puff-Birds (*Buceonidae*), a Neotropical family of small Picarian birds, with dense plumage of sober hue.

Puffendorf, SAMUEL, BARON VON (1632-94), jurist, was a native of Chemnitz. His first work, *The Elements of Universal Jurisprudence*, was written while in prison at Copenhagen, where he was tutor to the sons of the Swedish ambassador. He became professor successively at Heidelberg and Lund, and was afterwards historiographer to the king of Sweden. He died in Berlin, where he was writing the life of the Great Elector of Brandenburg. His chief work was the *De Jure Naturæ et Gentium* (1672).

Puffin, any bird of the genus *Fratercula* of the Auk family. The Common Puffin (*F. arctica*) is common on both shores of the North Atlantic, visiting Britain in the spring and remaining to breed. The length is about a foot, the upper surface is black, and the under surface and a space round the eye white. From their large, gaily-coloured bills, the sheath of which is shed



PUFFINS.

at the end of the breeding season, these birds are called Sea-Parrots and Coulternebs. They swim and dive well, and feed on fish and crustaceans. Their breeding-place is in a burrow, often stolen from a rabbit, and they lay but a single egg. The young birds, as well as the eggs, are used for food.

Pug, a name given to a breed of small smooth-haired dogs, said to have been introduced from Holland, though some writers also speak of a French breed. In shape, they resemble a miniature mastiff or bull-dog, and are kept as pets or house-dogs. From being pampered, and from their tendency to put on flesh, they are liable to many diseases which plain food and exercise would ward off.

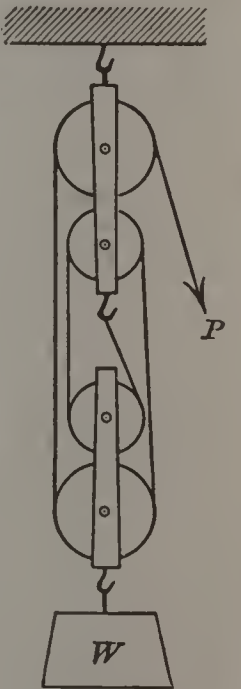
Pugilism (Latin *pugil*, "boxer"), fighting with the fists, a form of sport which was once very popular in England. The only kind of boxing that is still legal is that in which padded gloves are used. The "father of British pugilism" was John Broughton (1705-89), who in 1742 opened a theatre for boxing in Hanway Street, leading from Oxford Street to Tottenham Court Road. He was the first to discard the backsword, quarterstaff, and other weapons hitherto used in public fights. The rules drawn up by him remained in force till 1838. Of the pugilists who succeeded Broughton in the championship, those whose names are best known were John Jackson (1769-1845), the friend of Byron and Moore, whose polite manners earned for him the name of "Gentleman Jackson;" Tom Cribb (1781-1848), a man much esteemed for his straightforward and simple-minded character; and Tom Sayers (1826-65). A prize-fight was witnessed by the allied sovereigns during their visit to England in 1814, and again by the Shah of Persia in 1873; but the increased vigilance of the police has now driven British pugilists to the Continent or America.

Pugin, AUGUSTUS WELBY (1812-52), the architect, was born in London of French parentage. He designed many Roman Catholic churches and cathedrals, and modelled much of the sculpture in the House of Commons; and also wrote several valuable architectural monographs. His reason gave way in his last years. His son, E. W. PUGIN (1834-75), followed in his footsteps as an architect.

Pugs, a group of small moths belonging to the genus *Eupithecia*, and including some forty English species. It is difficult to distinguish between these, as the ornamentation, etc., is all on the same pattern. The caterpillars are, however, often very different, and thus breeding is usually necessary to secure accuracy of identification.

Pulci, LUIGI, a Tuscan poet, born in 1432, was the author of *Il Morgante Maggiore*, a mock epic of great linguistic value, and several other humorous works. His two brothers, BERNARDO and LUCA, were also poets, and sang the praises of their patrons, the Medicis.

Pulley is a wheel whose edge is grooved for the reception of a rope or chain; one or more wheels or *shears* are usually fitted in a frame and called a *block*, the rope used with them being known as a *fall*. In using pulleys for ship's tackle or for lifting weights, it is necessary to determine the mechanical advantage of the arrangement, and these systems of combining pulleys (shown in the figures) are usually considered. The second of these is the only one of much practical importance. Looking at the upper pulley of system 1, and neglecting friction, it is evident that, as the tension in the cord due to the force P is the same in all parts of the string, there are two equal forces tending to lift the pulley, which is therefore raised with a force of $2P$. Repeating the process for the other pulleys, we obtain the result that the weight W which can be sustained by the force P is $P2^n$, when n is the number of pulleys. In the second system an equal upward tendency will be due to each string, so that in this case the force P can sustain a weight equal to P multiplied by the number of cords going to or from the lower block. In the



same way it can be shown that in the third system $W = P(2^n - 1)$ when n is the number of pulleys. In practice it is found that the loss due to friction is about 10 per cent. per pulley.

The *differential pulley* has one fixed wheel with two grooves and a movable wheel to which the weight is attached. A continuous chain passes round these as shown in the figure (Fig. 4), slipping being prevented by recesses in the grooves, which fit the links of the chain. The moment of the forces due to the weight, acting in the direction of the arrow, is $\frac{W}{2}(ac - bc)$, and if the weight be just sustained,

the moment of P , which is $P(ac)$, must be the same. It thus follows that $W = P \frac{2ac}{ac - bc}$, or the

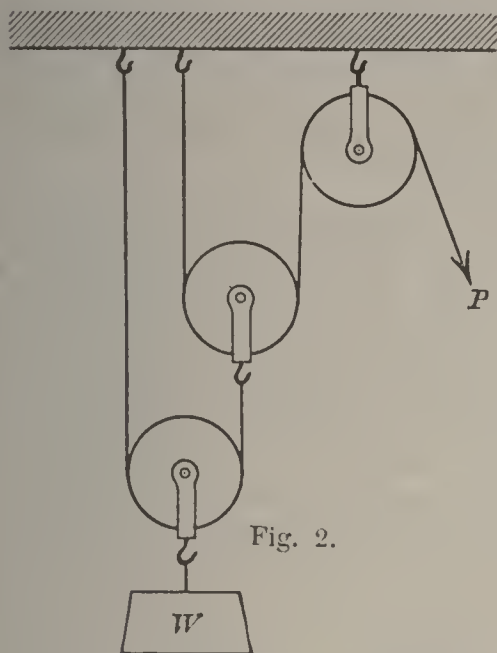


Fig. 2.

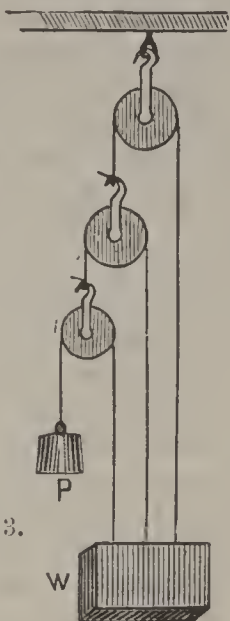
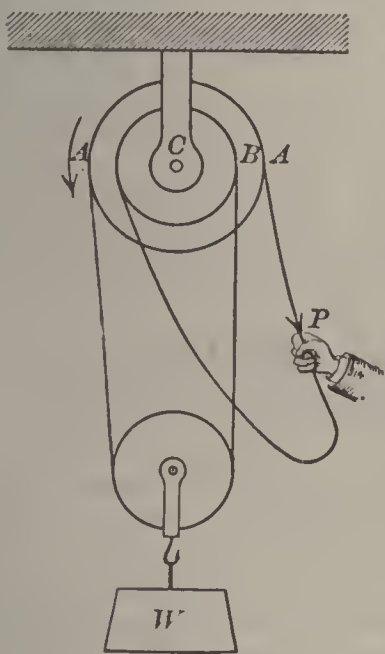


Fig. 3.

PULLEYS. Figs. 2 and 3.

mechanical advantage equals the radius of the large groove divided by the difference between the radii of the two grooves; by making them nearly equal a very great weight may be lifted by a comparatively small force. The friction of the arrangement is, however, very considerable. Pulleys are also used in the transmission of power from one rotating shaft to another. They have smooth faces for belts or grooves for ropes. The larger the number of movable pulleys, the greater the mechanical advantage.



PULLEY. Fig. 4.

[BELT-GEARING, ROPE-GEARING.]

Pulmonata, the order of Mollusca the members of which have univalve shells, the nerve loop not twisted, and breathe by a pulmonary chamber or lung instead of gills. Owing to the simplicity of the arrangement of the nerves, they are included in the section Euthyneura of the unsymmetrical Gastropoda. Another group of terrestrial air-breathing univalve Mollusca, including *Cyclostoma*, used to be included in the Pulmonata; but they are now excluded from it, as they belong to the Streptoneura (q.v.). The Pulmonata are divided into two sub-orders: the Basommatophora, in which the eyes are at the base of the tentacles, as in the pond snails *Planorbis*, *Auricula*, etc., and Stylommatophora, in which the eyes are elevated on tentacles, as in the snails *Helix* and *Clausilia* and the slugs *Arion* and *Limax*. [BASOMMATOPHORA, GASTROPODA, STYLOMMATOPHORA.]

Pulpit, the elevated stage or desk in a church from which sermons are preached. They were formerly erected also in the refectories of monasteries, in cloisters, and in public thoroughfares; there is one in the outer court of Magdalen College, Oxford. In former times the pulpits in churches were invariably placed in the nave, the officiating priests and other occupants of the choir removing thither during the delivery of the sermon. Many churches in England contain ancient pulpits, either of wood or stone, especially in Somersetshire and the neighbouring counties. Few of these are earlier than the Perpendicular period; but at Beaulieu, in Hampshire, there is a rich example of Early English or early Decorated date. Stone pulpits were often constructed in the face of the wall and were approached by a hidden staircase. Pulpits of both kinds were usually polygonal and often much enriched, a common feature being the canopy or tester, of which there is a fine example at Castle Ashby, Northants.

Pulque, a Mexican alcoholic beverage made from the juice of various kinds of agave.

Pulse. Corresponding to each injection of blood into the arterial system, by the contraction of the left ventricle of the heart, there is a distension of the arterial tubes. This rhythmical distension can be seen in the temporal arteries of thin persons, and can be readily felt in the radial artery, which is situated quite superficially at the wrist. If one end (the short arm) of a lever be applied to the radial artery, the end of the long arm gives in exaggerated form a record of the pulsation of the vessel, and if such movement be recorded on a travelling surface what is called a sphygmographic tracing is obtained, the instrument used in making such tracing being called a *sphygmograph*. On such a tracing the sudden rise and more gradual fall of the pulse-wave will be depicted, and occasionally the line of ascent or descent may be broken by a notch, a common appearance being such a break near the middle of the down curve (the dicrotic notch). The chief characters of the pulse as appreciated by the fingers are its frequency, its suddenness, the tension of the artery between the pulse-beats, the fulness or smallness of the pulse, and the condition of the arterial coats. The normal pulse-rate in the adult is from 70 to 80 beats a minute. Immediately after birth the average number of pulses is from 130 to 140 a minute, and in the third year the normal rate is still nearly a hundred. The frequency of the pulse diminishes until adult life is reached, and it then undergoes still further, though more gradual, diminution with advancing years. Sometimes the characters of the pulse are almost sufficient in themselves to establish the diagnosis of certain forms of disease, as, for example, in the "water-hammer pulse" of aortic regurgitation. The study of the pulse is, moreover, a valuable guide to treatment, particularly in fevers.

Pulteney, WILLIAM (1682-1764), the opponent of Walpole, entered the House of Commons as a Whig in 1705. On the accession of George I. he became a Secretary of State, but in 1717 went out

of office with Walpole. When the latter became Premier, he was offered a peerage, but no office, and after a short time joined the Opposition against him. To his eloquence and skill as a writer Walpole's fall was largely due; but Pulteney felt himself unable to take his rival's place, and contented himself with the title of Earl of Bath. In 1746 he (with Carteret) attempted, but failed, to form a ministry.

Puma (*Felis concolor*), a large cat, ranging over the American continent between lat. 60° N. and 50° S. The thick close fur may vary from a yellowish to a silvery-grey above, and the under surface and the insides of the limbs are white. It is about the size of a leopard, and is generally called by Americans the "painter" or "catamount." It is extremely active and very destructive to cattle and sheep, though it never attacks man, for whom it is said it has such liking that it will scarcely defend itself if attacked by him. In confinement the puma readily becomes tame and gentle, and it has been kept as a pet. The cubs resemble those of the lion in that they show signs of darker markings on the ground colour.

Pumpkin (*Cucurbita Pepo*), an annual plant, belonging to the order Cucurbitaceæ, of uncertain nativity. It has been cultivated in England since 1570. It has large, rough, five-lobed leaves, unbranched tendrils, and an oblong fruit varying in size and shape, but often very large. Mixed with sliced apples, sugar and spice, and baked, it is eaten as *pumpkin pie*, a dish now more familiar in America than in England, where this vegetable has been largely superseded by its variety, the Vegetable Marrow (q.v.).

Pumps are machines for raising or moving water and other fluids. The commonest form, or suction pump, consists of a cylinder or "barrel," to the bottom of which is joined a pipe which dips below the surface of the liquid to be raised. A valve opening upwards is fitted at the junction of barrel and pipe, and a piston can be moved up and down in the barrel by means of a lever and handle. The piston is also provided with a valve capable of moving upwards, and the outlet for the liquid is near the top of the barrel. Imagine the piston to be moving upwards from its lowest position; atmospheric pressure keeps the piston valve closed, and a partial vacuum is obtained beneath it—hence the liquid rises in the pipe, opens the junction valve, and follows the piston upwards. After a while the piston is caused to descend; the liquid beneath it pushes its way through the piston valve, for its pressure causes the lower valve to shut, and so its retreat is cut off. The next time the piston rises, the liquid above it is carried to the outlet, where an intermittent stream is therefore obtained. If a long pipe be connected to the outlet, and the top of the barrel be provided with a stuffing-box fitting the piston-rod, the water can be lifted to any height in the pipe. This form of pump is known as the lifting pump.

If, again, there be no valve in the piston, but a second pipe leading from the bottom of the barrel

be provided with a valve opening into it, liquid will be forced into this pipe as the piston descends. This is known as the force-pump. An air chamber is often attached to the outlet pipe to equalise the flow of liquid. The fire-engine and the steam-engine feed-pumps are always of this type. Specially modified forms of pumps are used for acids, soap, sludge, etc. [CENTRIFUGAL-PUMP, STEAM-PUMP, AIR-PUMP.]

Punch, the name of the hero in the puppet show, is an abbreviation of Punchinello, the original form of which is said to have been Pulcinello (Italian, "little chicken"); but on this theory the name implies something small, whereas the character of Punchinello is said to have been derived from the ordinary Neapolitan stage-comedy. Whatever truth there may be in the view which regards Punch as the descendant of the Maccus of the Atellanæ (q.v.), there can be no doubt that in his present character, at any rate, he is a creation of modern times. His invention is ascribed to Silvio Fiorillo, a comedian who lived at the beginning of the 17th century. Punch soon became popular in France, and seems to have been introduced into England soon after the Restoration.

Punch, a drink derived from India, the designation of which is due to the fact that it is properly composed of five (Hindu, *panch*) ingredients—arrack, tea, sugar, water, and lemon-juice. The last three of these are mixed with alcohol to form the punch now drunk in England, the name (brandy-punch, etc.) differing according to the liquor employed. Wine, tea, and other ingredients are sometimes added.

"Punch ; or, The London Charivari," the leading English comic journal, was started in 1841 under the editorship of Henry Mayhew and Mark Lemon. Many well-known writers have contributed to its pages, including W. M. Thackeray, Tom Hood, Douglas Jerrold, and Albert Smith. *Punch* was conspicuous from the outset for the excellence of its illustrations; and the reputation established by H. K. Browne, Doyle, and Leech, has been worthily maintained by Tenniel, Du Maurier, and Linley Sambourne.

Punctuation, the use of certain marks or signs which are supposed to indicate the divisions into which a sentence naturally falls. Those most commonly employed are the full stop or period (.), colon (:), semi-colon (;), comma (,), mark of exclamation (!), mark of interrogation (?), inverted commas (" "), dash (—), and brackets () or [].

Punjab ("five rivers"), a large province in the north of British India. Strictly speaking, the name applies to the wedge of territory enclosed between the Indus, the Sutlej, and the Himalayas, including the tributary basins of the Jhelum, Chinab, Ravi, and Bias; but the political boundary has been extended E. as far as the Jumna, S. to within a short distance of Delhi, and W. to Peshawar, Bamu, and the frontiers of Dera Ismail and Dera Ghazi Khan. The whole area is 106,632 square miles, but the feudatory states of Patiala, Nabha, Bhawalpur, Kapurthala, etc., comprise 35,817 square miles. The

tracts between the chief rivers are known as *doabs* ("two rivers"), and that which separates the Indus from the Jhelum is traversed by the Salt Range, containing vast supplies of rock-salt. Coal and petroleum are found in this neighbourhood. The climate, though exceedingly hot in summer and cold even to frost in winter, cannot be regarded as unhealthy. Lahore is the capital, and other important cities are Multan, Ludiana, Amritsar, Ambala, Rawal Pindi, Sialkot, Muzaffargarh, and Peshawar. About half the population consists of Mohammedans, Hindus and Sikhs making up nine-tenths of the other half. Besides the ordinary native industries, carpet-weaving, silk-embroidery, shawl-making, and many special forms of ornamental art are carried on at Lahore, Multan, and elsewhere.

Punkah, a cloth stretched on a frame which is hung from the ceiling and kept in motion by a servant, the object being to cool the air of the apartment.

Pupa, the stage in the development of an insect which intervenes between the caterpillar and the perfect insect. It may be quiescent, as in the larvæ of butterflies, which are known as chrysalids; or may be active, as in all insects having an "incomplete" metamorphosis.

Purānas (Sanskrit, "old"), a body of religious compositions on which the popular faith of the Brahminical Hindus is mainly based. They are written in epic couplets, and consist to a large extent of epic myths and legends, much space being also devoted to the character of the gods and the origin of the universe. They are ascribed to Vyāsa, but, in their present form at any rate, they are probably not later than the 9th or 10th century of our era.

Purbeck Beds, the highest series of the Jurassic rocks in England, typically developed in the Isle of Purbeck, in Dorsetshire; but occurring also in the Isle of Portland; at Swindon; near Aylesbury; and near Battle, in Sussex. It passes, with but little break, downward into the marine Portlandian, and upward into the fresh-water Wealden series (q.v.); but itself combines marine and fresh-water rocks. It is divided into three parts, the lower, mainly fresh-water limestones or *Purbeck marble*, made up of shells of mussels (*Unio*) and of snails (*Viriparus*), with shales, and "dirt-beds" or ancient soils; the middle, mainly marine; and the upper, again fresh-water. A bed of oyster-shells (*Ostrea distorta*), 12 feet thick, is one indication of marine life, and considerable beds of gypsum point to the evaporation of inland waters. Many insect remains occur at some horizons, and chelonian and crocodilian remains (*Goniopholis*) are frequent. Near the base of the Middle Purbeck, at Swanage, the lower jaws of various rat-kangaroos have been discovered, as if dropped by carcasses floating in an estuary. The Purbeck marble of Dorsetshire was much used in the mediæval architecture of southern England and the gypsum discovered in the Sub-Wealden boring near Battle is now worked.

Purcell, HENRY (1658-95), the great English musician, was born in Westminster. In 1680 he became organist of Westminster Abbey, and two years later was appointed to the Chapel Royal. He excelled in all kinds of music, and his chants and anthems are still often heard in churches. His glees and cantatas are also a frequent feature in chamber concerts; and his setting of the songs in the *Tempest* is the delight of all music lovers. Purcell was buried in the Abbey.

Purchas, SAMUEL (1577-1626), rector of St. Martin's, Ludgate, and chaplain to Archbishop Abbot, was author of the curious works entitled *Purchas his Pilgrimage; or, Relations of the World and the Religious Observer in all Ages* (1613), and *Hakluyt's Posthumus; or, Purchas his Pilgrimes, containing a History of the World, in Sea Voyages and Land Travels by Englishmen and Others* (1625).

Purgatives are drugs employed with a view to producing increased intestinal action, whether it be by promoting excretion of the intestinal glands by the administration of salines or of cathartics (q.v.), or by increasing peristalsis by stimulating the nervo-muscular structures of the alimentary canal. [CONSTIPATION.]

Purgatory, a place in which, according to the doctrine of the Roman Catholic Church, expiation is made for sins which remained unpunished during the sufferer's lifetime. The belief in such a place rests on the view that, although the penalty of eternal torment has been remitted through the death of Christ, Divine justice requires that every sinful act should be followed by temporal punishment, either in this world or in the next. Gregory the Great was the first who distinctly formulated the doctrine afterwards accepted by the Councils of Florence (1439) and Trent (1545-63). The canons of these Councils not only assert the existence of a Purgatory, but declare that the sacrifice of the Mass and the prayers and alms of believers are efficacious in relieving the sufferings of those who are there detained. They make no statement, however, as to the locality of Purgatory or the character and duration of the punishment.

Purim, a Jewish feast which commemorates the deliverance of the nation from the machinations of Haman related in the Book of Esther. It takes place on the 14th and 15th of Adar, and is always celebrated with much merry-making. Both the feast and its name have been traced to the Persian *Furdigan* (*Pōrdiyān*).

Puritanism. [PURITANS.]

Puritans, a name given to those who refused to assent to Elizabeth's Act of Uniformity on the ground that it was too favourable to Romish doctrine and ritual. According to Strype, it was first applied in 1569, but Fuller mentions its use as early as 1564. The earlier Puritans for the most part advocated a Presbyterian form of government; Hooker's *Ecclesiastical Polity* marks the final position of the Church of England against them. During the reigns of James I. and Charles I. the main body of the Puritans continued to hold

Presbyterian and Calvinistic views; but the Independents were now gaining strength, and before the establishment of the Commonwealth the term Puritan had become identified with them rather than the Presbyterians. The change in the use of the term was justified by the character of those to whom it was applied, for the Independents were even more remarkable for their austere lives than the Presbyterians. After the Restoration the term "Puritan" fell into disuse, "Nonconformist" and "Dissenter" taking its place. [INDEPENDENTS, PRESBYTERIANS.]

Purple Emperor (*Apatura iris*) is one of the most beautiful of British butterflies. It is of a fine purple colour, dotted with white in the male and yellow in the female.

Purpura, the term applied to the condition in which extravasations of blood occur beneath the surface of the skin. These extravasations form discoloured blotches, at first red, and subsequently changing their colour after the manner of a bruise. They do not disappear on pressure, and gradually fade away, sometimes to be succeeded by further crops. Purpuric spots are met with in certain fevers and in conditions of anæmia and malnutrition, sometimes in association with rheumatism and with scurvy.

Purpurin, a dye-stuff which occurs, together with *alizarin* (q.v.), in the madder root. It may be prepared from alizarin, to which it is very closely allied chemically, by heating it with an oxidising agent. Its composition is represented by $C_{14}H_8O_5$, and it forms orange-coloured crystals soluble in hot water. It may be mordanted on to cloth, and, together with many of its derivatives, is used as a dye. Its chemical reactions show it to be a derivative of the compound known as *anthraquinone*.

Pus, or MATTER, is the yellow fluid which is sometimes formed as the result of inflammatory processes. It consists of pus cells, which resemble broken-down leucocytes, and of granules, fatty matter and fluid material.

Pusey, EDWARD BOUVERIE (1800-82), was born in Berkshire, a grandson of the first Viscount Folkestone. The additional name of Pusey was assumed by his father on succession to the Berkshire estates. Educated at Eton and Christ Church, he became fellow of Oriel in 1823. After about two years spent in Germany he returned to Oxford, and from 1829 till his death held the Regius Professorship of Hebrew. Pusey was one of the chief leaders in the Tractarian controversy, and wrote the *Tracts on Baptism and the Eucharist*. To the *Library of the Fathers*, edited by himself, he contributed translations of St. Augustine's *Confessions* and some works of Tertullian. In 1843 Pusey's views were condemned by the theologians of the university, and he was suspended from preaching for three years. After the secession of Newman he became the leader of the High Church party in the English Church, and the older school of Ritualists were called Puseyites. His chief works at this period were those on *The Royal Supremacy* and

The Doctrine of the Real Presence. Later came the *Eirenicon* (1865-70), a statement of the grounds he thought proper for reconciliation with Rome. In later years he also wrote against the Rationalists, defending the received date of the Book of Daniel and the dogma of Eternal Punishment. Pusey's life by Liddon was prepared for publication by the latter's literary executors.

Pushkin, ALEXANDER SERGEIEVITCH (1799-1837), the Russian poet, was a native of Moscow. In early life he was sent to Bessarabia on account of his revolutionary views, but his ability and popularity afterwards procured him the post of historiographer. His fame as a poet was gained by the tragedy *Boris Godunov* and some excellent lyrics; but he was almost equally distinguished as the writer of *Eugene Onegin* and the *History of the Revolt of Pugachev*. There is an English version of the former.

Pustule, a small accumulation of pus occurring below the surface of the skin. Pustules usually begin as vesicles, the clear fluid of which takes on a purulent character. Malignant pustule is the term applied to the local lesion of anthrax (q.v.).

Putnam, ISRAEL (1718-90), an American general born in Massachusetts, saw much service against the French. In 1758 he was captured and tortured by the Indians, and was barely rescued from death. In 1762 he went on the Havannah expedition, and two years later to the relief of Detroit. In 1775 he commanded the forces of Connecticut against the British, and, having been made a major-general by Congress, soon after headed the American forces at Brooklyn. He subsequently commanded on the Hudson and elsewhere, and was celebrated for his personal courage. His cousin, RUFUS PUTNAM (1738-1824), was a general of ability who was for a time surveyor-general. Another member of the family, GEORGE PALMER PUTNAM (1814-72), was the author of *A Plea for International Copyright* (1837).

Putney, a suburb of London on the Surrey side of the Thames, about eight miles above London Bridge, was in existence at the date of Domesday Book, and has long been a favourite residential district, numbers of villas having sprung up on either side of the old High Street and around the adjoining common.

Putting, in golf, the act of playing the ball when it is within a very short distance from the hole. Each hole is surrounded by a smooth-kept piece of turf, known as the *putting-green*.

Puy de Dôme, a department of France, bounded N. by Allier, S. by Haute-Loire and Cantal, E. by Loire, and W. by Corrèze and Creuse. The name is derived from an extinct volcano, at the foot of which the capital, Clermont-Ferrand, is built. The ranges of the Monts Dore and Monts Dôme on the W. and of the Monts du Forez in the E. enclose the fertile plain of Limagne, which yields heavy crops of cereals, beetroot, rape, and wine, besides fruits of all kinds. About half of the total area of 3,000 square miles is under cultivation,

but the mountain pastures support vast numbers of cattle and sheep. The district is drained by the Loire, with its tributaries the Allier, Cher, and Gironde, and by the Dordogne and other smaller streams. Mineral springs of medicinal virtue attract many invalids to Royat, Mont Dore les Bains, La Bourboule, and other thermal stations. Among the leading industries are wool- and cotton-spinning, cutlery, paper- and lace-making, leather-dressing.

Puy, LE, a town in the department of Haute-Loire, France, 65 miles S.W. of Lyons. Close by are Mont Corneille, on which is a colossal statue of the Virgin, and another volcanic cone, Le Rocher de St. Michel, supporting an ancient chapel. The cathedral dates from the 6th to the 12th century. The manufacture of laces and blondes in various materials employs many thousands of hands, and there is a large general trade.

Pyæmia is derived from the Greek words signifying pus and blood, and is the term applied to a febrile malady due to the entrance into the blood of septic or inflammatory material. The active cause of the mischief in such material is probably some form or forms of micro-organism. Pyæmia occurs in connection with various kinds of injury, particularly compound fracture of the long bones. It is met with after surgical operations, and as the result of certain conditions attended by inflammation, such as erysipelas, carbuncle, peritonitis, etc. Puerperal fever is a form of pyæmia. The disease is often attended by the formation of secondary abscesses, and to those cases in which no such secondary pyæmic formations occur the term septicæmia is sometimes applied. Cases of well-marked pyæmia frequently prove fatal; prompt surgical interference is sometimes, however, effectual in checking the progress of the malady.

Pycnogonida, a group of Arthropoda (q.v.) the position of which is very doubtful, as it combines the characters of the Arachnids and Crustacea. Thus, though they are all marine, they possess no special organs for respiration, while they have only eight legs, an Arachnid character. The embryos, when not internal parasites, closely resemble the larva known as Nauplii (q.v.), and this suggests that they are Crustacean. It is possible that the order is a primitive one which resembles the ancestral form of both Crustacea and Arachnida. They are popularly known as Sea-Spiders; some genera, such as *Nymphon* and *Pycnogonum*, are not uncommon on the English coast.

Pym, JOHN (1584–1643), was born in Somersetshire and educated at Oxford. He entered Parliament in 1614, and very soon made his mark as one of the impeachers of Buckingham. He increased his reputation by his speeches during the debates on the Petition of Right, and as leader of the popular party moved the impeachment of Strafford, and was the chief manager of the trial. He also drew up the Grand Remonstrance. Pym was the chief of the five members whom Charles I. tried to impeach for treasonable correspondence with the Scots. After the failure of the attempt he became the most powerful man in the kingdom,

and was called by the Royalists "King Pym." Although a Presbyterian, and a man of no extreme views, he retained his influence to the last, and just before his death was made Lieutenant-General of the Ordnance. He lived to bring about that alliance with the Scots which was to be the deciding factor in the Great Rebellion. Pym lies buried in Westminster Abbey.

Pyramids, structures with square bases and triangular sides, which slope to an apex, erected at different times in various parts of the world, the most remarkable being those in Egypt. The name is Egyptian and strictly applies only to the vertical height of the building, but was used by the Greeks (who converted *pir-em-us* into *pyramis*) of the whole structure. The Egyptian pyramids, of which there are some 70 or 80, occur in Middle Egypt alone. There can be little doubt that their sole purpose was to commemorate the kings above whose sepulchres they stand. These monarchs belonged to the various dynasties from the 4th to the 12th, and lived between 4000 and 2000 B.C. The first step in the construction of the pyramids, which were invariably built during the lifetime of those for whom they were intended, was the excavation of the gable-roofed, subterranean chamber designed to hold the sarcophagus. When it was finished horizontal layers of roughly-hewn blocks of stone, with some mortar, were placed over it, the opening through which the sarcophagus was to descend being left uncovered. The rubbly character of the pyramids gradually increased, till eventually the greater part consisted of mud bricks; but even the latest specimens retained the outer casing of highly-finished stone work which completed the structure. In most cases this has now disappeared, having been either destroyed by foreign invaders or carried away to erect buildings in the Egyptian towns. The faces of the pyramids look towards the cardinal points, the entrance to the passage which leads to the sepulchral chamber being either in the northern face or in the ground in front of it. The way through the passages was barred by portcullises, the secret of opening which was probably known to the priests alone. The sepulchral chamber is sometimes situated within the body of the pyramid, instead of underneath it, and sometimes there is more than one, as, for example, in the great pyramid of Gizeh, the internal arrangements of which are quite exceptional.

Pyramus and Thisbe, two Babylonian lovers whose tale is told in Ovid's *Metamorphoses*, and best known from Shakespeare's *A Midsummer Night's Dream*. Pyramus, finding one night his mistress's robe stained with blood, concluded she was dead, and killed himself; and Thisbe, who had fled from a lioness, when she found his dead body also put an end to her life.

Pyrenees, THE, a range of mountains, about 240 miles in length and 50 miles in breadth, which stretches from the Bay of Biscay to the Mediterranean and divides France from Spain. The height is remarkably uniform, the chief peaks—such as Maladetta or Nethou (11,165 ft.), Posets (11,047 ft.), Mt. Perdu (10,994 ft.) and the Vignemale (10,820

ft.)—being W. of the central point. On the French side the ascent is very gradual, but the Spanish face offers steeper precipices. Very remarkable are the *cirques* or circular basins, that of Gavarnie being the most famous. Many *ports* or passes traverse the range, but only five are practicable for carriages. Geologically the Pyrenees consist, like the Alps, of a granite base capped by various sedimentary strata, from the Cambrian to the Tertiary periods, limestones largely predominating.

Pyrénées. Three departments of France take their names from different sections of the range above described:—

is 1,742 square miles. The products are much the same as in the Basses-Pyrénées. Mineral springs exist at St. Sauveur, Barèges, Caunterêts, and Bagnères, which with Lourdes (a great place of pilgrimage), Argelès, and Tarbes, the capital, are the chief towns.

PYRÉNÉES-ORIENTALES (or EASTERN), is bounded N. by Ariège and Aude, E. by the Mediterranean, S. by Spain, and W. by Ariège. The area of 1,592 square miles is divided by the Albères, the Corbières, and the branches of the Pyrenees into three valleys, running E. and W. and merging to the N.E. in a wide plain. Good crops of grain, olives, and fruits are produced, but viticulture is the principal source of wealth, the wines of



THE GREAT PYRAMID OF GIZEH, WITH THE SPHINX.

BASSES (or LOWER) PYRÉNÉES occupies an area of 2,943 square miles, in the angle of the Bay of Biscay, being bounded N. by Landes and Gers, S. by Spain, E. by Hautes-Pyrénées, and W. by the Atlantic. The mountains towards the W. seldom exceed 3,000 ft. in elevation, but rise gradually in the E. to 8,000 or 10,000 ft., as in the case of Anie, Mourous, and Ossau. The valleys, in spite of excessive humidity, are fertile, producing barley, oats, rye, wine, chestnuts, and vegetables, whilst there is good pasturage for cattle and sheep. Mineral springs exist at Eaux Bonnes, Eaux Chaudes, Cambon, and other places. Pau, the capital, Biarritz, and St. Jean de Luz, on the coast, are well-known health-resorts, and Bayonne is the only commercial port.

HAUTES (or HIGH) PYRÉNÉES, lies E. of the preceding, having Spain as its S. boundary, Haute-Garonne to the E., Landes and Gers to the N.W. and N.E. Within its borders are found the highest peaks, and the southern half is extremely wild and rugged; but fertile valleys open out to the north, where corn, wine, and cattle thrive well. Its area

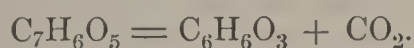
Roussillon and Rivesaltes being much esteemed. The climate and products, especially in the coast districts, are those of Corsica and Italy. There are no good harbours, the coast being fringed with shallow sandy lagoons. Port Vendres and Barcylul enjoy the largest share of traffic. Perpignan is the capital, Céret, Rades, and Amélie-les-Bains being towns of minor importance.

Pyridine is an organic compound of the composition C_5H_5N . The constitution is closely analogous to that of benzene (q.v.), the nitrogen atom replacing one of the CH groups of that compound. It closely resembles benzene also in very many of its chemical reactions. It occurs with other derived substances in coal-tar (q.v.), and to a greater extent in "bone-oil" or "Dippel's oil." In its chemical behaviour it plays the part of a basic substance, and is an example of the substances known as organic bases. It is a limpid, colourless liquid which boils at 115° . It mixes with water in all proportions, has a pungent smell, and possesses a specific gravity of 1.003.

It gives rise by substitution of some of the hydrogens, or by addition of other elements or groups, to a large number of derivatives. It is of great chemical interest owing to the fact that many of these derivatives are closely allied to some of the substances known as *alkaloids*, while many of the compounds which within recent years have attracted considerable attention, the *ptomaines*, have been shown to be also pyridine derivatives. [BENZENE, QUINOLINE.]

Pyrites, a term (derived from the Greek *pur*, "fire") originally applying only to the hard iron-disulphide (FeS_2) which would strike a light with flint or steel, but afterwards extended to various other metallic sulphides, such as copper-pyrites, arsenical-pyrites, etc. Iron-pyrites occurs as two distinct mineral species: the more readily decomposed prismatic *marcasite* (q.v.), and the cubic *pyrite*, the *mundic* of miners. The latter is of a brass-yellow colour, and crystallises in pentagonal dodecahedra, cubes and combinations of the two, the faces of the cube being striated parallel to edges of the dodecahedron. It was formerly used in wheel-lock guns as a strike-light; but, though nearly half iron, is, on account of the sulphur, of little value as a source of iron. It is worked for sulphur, and used in the manufacture of sulphuric acid. A cupreous variety, with under 3 per cent. of copper and traces of gold and silver, occurs in enormous deposits at Rio Tinto and elsewhere in the province of Huelva in Spain, and in Portugal, at the junction of intrusive igneous rocks with Devonian slates. We import over 600,000 tons annually, valued at over one and a quarter million pounds sterling, mainly from this region.

Pyrogallie Acid is a compound known chemically as a trihydroxy benzene, being represented by the formula $\text{C}_6\text{H}_3(\text{OH})_3$. It is hence an example of a trihydric phenol. [PHENOL.] It is obtained by heating gallic acid (q.v.), when the compound breaks up into pyrogallie acid and carbonic acid—



It forms white leafy crystals which melt at about 115° . It is very soluble in water, and the solution possesses the property of absorbing oxygen. Owing to this it is largely employed in gas analysis to estimate the quantity of oxygen in a gaseous mixture, the diminution of volume in the gas when shaken with a small quantity of a solution of pyrogallie acid being equal to the volume of oxygen originally present. Large quantities are employed in photography, as it forms a "developer" [PHOTOGRAPHY] which, if carefully used, is certainly unsurpassed by any of the newer chemicals employed for the same purpose, and in this country, at least, is still the developer principally used.

Pyrolusite is an ore of manganese, and consists chemically of the dioxide of this metal, MnO_2 . It occurs in large masses, and also in rhombic crystals. It possesses a specific gravity of about 4.8 and a hardness of about 2.5. It was for a long time considered to be an ore of iron, and its true nature was first demonstrated by the

Swedish chemist Scheele. It was used at a very early date in glass-making (q.v.) for the purpose of decolorising glass rendered green by iron. It was formerly termed *magnesia* or *lapis manganensis*, and only incompletely distinguished from the loadstone or *magnes*. It is employed chemically as a source of oxygen and in preparation of chlorine in the manufacture of bleaching powder. It is also used in glass-making, and as a source of the manganese compounds. The principal localities where the mineral occurs are Bohemia, Spain, France, the United States and Nova Scotia, whilst small quantities are found in Devonshire. As obtained naturally it is seldom pure, being usually mixed with oxides of iron, nickel, and cobalt.

Pyrometer is an instrument for measuring very high temperatures, and is specially required to measure the heat of furnaces. An air or gas thermometer is sometimes used, the temperature being calculated from the expansion undergone by the gas, the pressure being constant, or from its increased pressure at constant volume. A simple form of it consists of a bulb (of glass or some other suitable material) which is drawn out into a fine neck. It is filled with dry air, exposed to the heat of the furnace, and when it has attained this temperature the neck is sealed up with a blowpipe. It is removed, allowed to cool, and the point of the neck broken off under mercury. This liquid rises into the bulb, the levels of the mercury inside and outside the bulb are equalised, the opening is temporarily closed, and the bulb with the mercury it now contains is weighed. This weight, together with the weight of the bulb when full of mercury, are data from which the expansion of the air and hence the temperature, can be deduced. Hydrogen, nitrogen, mercury vapour, and iodine vapour have in their turn all been used instead of air. Another method of measuring high temperatures is to expose pieces of various alloys to the heat of the furnace, and note which of them melt, the melting-points of these alloys having been previously determined. Prinsep arranged a series of such alloys (of silver, gold, and platinum), whose melting-points ranged from 945° to 1775° . Again, a piece of platinum may be exposed in the furnace for some time and then plunged into water in a calorimeter. From knowing the specific heat of platinum for a long range of temperatures, and noting the temperature to which it raises the water, the temperature of the furnace can be calculated. Measurements of the expansion of earthenware or metal rods have also been used, the most successful being Bregnet's device, in which strips of gold, silver, and platinum are fastened together in a spiral, whose end moves as the temperature alters. In electric pyrometers a spiral of platinum wire is heated in the furnace, the temperature of which is estimated from the alteration in its resistance.

Pyro-morphite is an ore of lead which consists of a double phosphate and chloride of that metal, represented by the formula $\text{Pb}_5(\text{PO}_4)_3\text{Cl}$. It is interesting on account of its isomorphism with the minerals *apatite* and *mimetesite*. It is not

employed as a source of the metal. It occurs chiefly in hexagonal crystals of hardness 4 and specific gravity about 6.8.

Pyrosis. [WATERBRASH.]

Pyrotechny, the art of producing an attractive scenic display by the application of fire. Fireworks have been known to the Chinese from a very remote period, but the first attempt to construct them in Europe was the result of the invention of gunpowder in the 13th century. To produce the desired result there must be a combination of combustible or oxidisable materials, such as carbon and sulphur and their compounds, with substances which promote their speedy combustion, such as nitrate and chlorate of potash, the oxygen contained in these salts occasioning the rapid consumption of the forementioned materials when fire is applied. The variety in colour, on which the beauty of fireworks chiefly depends, is produced by means of simple metals, compounds of which are introduced as ingredients into the mixture. The compositions which have been described are placed in cases of paper or pasteboard—usually cylindrical in form—the construction of which requires great care. A due relation must be observed between the length and the diameter, and it is essential that the aperture through which the burning materials are to escape should be of the right size. Most fireworks are capped with touch-paper, prepared with a solution of nitrate of potash in alcohol. a quick-match of cotton-wick being used to unite the parts of complex designs and portfires containing saltpetre and similar materials to set fire to the cappings.

Pyroxene, a group of silicates of magnesium, calcium, iron, and sodium, with or without aluminium, so named from their infusibility. Though almost identical in composition with hornblendes, they differ in not being pleochroic, and seem to have resulted from more rapid cooling. Some of them, such as augite (q.v.) and diallage (q.v.), crystallise in the Oblique system, but in forms unlike those of the hornblendes. Others, such as hypersthene (q.v.), enstatite (q.v.), and bronzite (q.v.), belong to the Prismatic system, and are known collectively as Rhombic pyroxenes. Pyroxenes occur in diabase, basalt, gabbro, and other basic lavas, seldom associated with either quartz or orthoclase.

Pyrrhic Dance, the most celebrated war-dance of the ancient Greeks. It was much in favour at Sparta.

Pyrrhon was born at Elis towards the end of the 4th century B.C., and lived to be nearly a hundred. He followed Alexander the Great in his campaigns with his master Anaxarchus. He was the earliest of sceptical thinkers, "Pyrrhonism" having become a proverbial appellation, but he left no writings.

Pyrrhus, the great king of Epirus, was born about 318 B.C., and succeeded to the throne in 295 B.C. Fifteen years later he took the part of the Greek colonies in Italy against Rome, and

invaded Italy. By the help of his elephants, which the Romans had never yet met with in battle, he was at first victorious, though the losses he sustained brought into use the expression "Pyrrhic victory." After having, however, concluded a truce with Rome, he turned his arms against the Carthaginians in Sicily, and received from them a check at the siege of Lilybæum. This was followed by the loss of many of his ships, and, on renewing the war with Rome, he was totally defeated near Beneventum by Curius Dentatus (274 B.C.). After his return to Epirus, Pyrrhus conquered Macedonia, but was unsuccessful in a war with Sparta; and, while besieging Argos in 272, was killed by a tile which a woman threw from a roof.

Pyrrol is a compound of composition C_4H_5N which occurs in coal-tar. It gives rise to a number of derivatives which more or less resemble those of benzene. In its nature pyrrol is of a slightly basic character. It occurs in bone-oil, and may be prepared synthetically. These synthetic formations, as well as the reactions of the compound, show that its composition must be represented by the formula



i.e. a chain of four CH groups closed by the group NH. It is a colourless liquid, which becomes coloured, however, if allowed to stand in contact with air. It boils at about 131° , and the substance itself, as well as its derivatives, is recognised by the formation of a deep indigo colour with isatin and sulphuric acid.

Pythagoras was born in Samos in the last quarter of the 6th century before Christ. He seems to have travelled widely, and to have acquired a knowledge of the then existing Greek philosophy as well as of the religious systems of the Egyptians, the Persians, the Phœnicians, and the Jews. About 530 B.C. he settled at Crotona in the south of Italy. Here the Pythagorean philosophy grew up. Politically its votaries became the aristocratic party, and after a period of domination they were defeated. Their leader is said to have died at Metapontum at the end of the century. Our knowledge of Pythagorean doctrines is derived chiefly from Philolaus, a successor of Pythagoras. Their central doctrines were those of the Transmigration of Souls and the Doctrine of Numbers, as well as the poetic notion of the Harmony of the Spheres. [ASTRONOMY, PHILOSOPHY, RELIGION.]

Pythian Games, THE, ranked second to the Olympic among the four national festivals of the ancient Greeks. They were established in 586 B.C. and took place in the third year of each Olympiad on the Crissæan Plain near Delphi. The gymnastic and athletic contests were less important than the musical ceremonies, the chief of which was the Pythian *nomos*, a composition for the flute commemorating the victory of Apollo over the dragon Python.

Python, a genus of Old-World serpents closely allied to the Boas of the New World, the type of

a family (*Pythonidae*). They are not venomous, but kill their prey by crushing it between the folds of their body. The tail is prehensile, and there are traces of rudimentary hind limbs. Pythons are found in Asia, Africa, and Australasia, generally near water, which affords them an opportunity of seizing small mammals as they come to drink. There is no truth in the story that these serpents cover their prey with saliva before swallowing it; but after a full meal they sink into a torpid state. Some, if not all, incubate their eggs. Specimens of from eighteen to twenty feet long are rare; the average size is much smaller, though still larger ones are said to have been met with.

Pyx (Greek *pyxis*, "box"), the vessel in Roman Catholic churches in which the consecrated bread is preserved. A lamp burns before it when the Host is inside.

Pyx, TRIAL OF THE, an annual trial held at Goldsmiths' Hall to test by weight and assay the quality of the gold and silver coins issued from the Mint during the previous year. The pyx is the box in which the specimen coins reserved for trial are kept. The verdict is delivered by a jury of goldsmiths headed by the King's Remembrancer.

Pyxidium, in botany, a seed-vessel, commonly a capsule, with the top falling away like a lid, as in the Henbane.

Q.

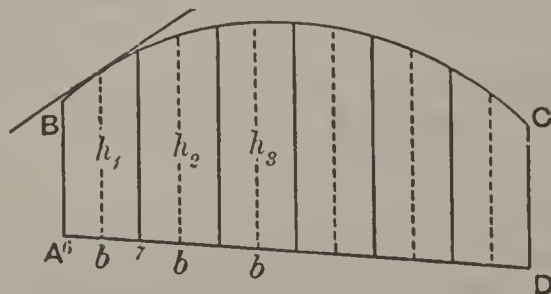
Q, the 17th letter of our alphabet, originated in the hieroglyphic symbol of a knee. Through the Phœnician *qoph* it passed into the Greek alphabet as the velar guttural *koppa* (*kw*), which was afterwards supplanted by the palatal *kappa* (*k*), surviving only as the symbol for 90. But amongst the Romans, who found it in the Chalcidian alphabet of Cumæ, it secured a lasting position. It made its way into Teutonic words very gradually; thus, in Middle English words of Saxon origin the sound is represented by *cw* till the latter part of the 13th century.

Quadrant is the fourth part of a circle and subtends an angle of 90° at the centre. The word has also been applied to an astronomical instrument for measuring the zenith distances of stars, etc. It is placed in the plane of the meridian and generally attached to a wall; hence it is often known as a mural quadrant. A telescope movable about the centre of the quadrant is provided with a vernier, and moves over the divided arc whose zero is the end of a vertical radius. Tycho Brahe used a quadrant also for measuring azimuths, and in this case it was adjusted on a vertical axis. In modern times the quadrant has been almost entirely superseded by the mural circle (q.v.), in which much greater accuracy can be obtained, even though the instrument itself be smaller. In the quadrant error, due to the centre of revolution not coinciding with the centre of the division, is certain to occur; but

in the mural circle this is at once eliminated by taking readings on two opposite verniers. Hadley's quadrant (q.v.) is now usually known as Hadley's sextant.

Quadrature really means the determination of a square whose area shall be equal to that of any given surface. The area of such surface can, however, be found without the *actual* determination of the equivalent square; hence the term quadrature is now applied to any process which gives a means of expressing the area in terms of any definite unit. [QUADRATURE, METHODS OF.] The quadrature, or squaring of the circle, is a problem which has excited much attention from most remote times, and is often classed with that of finding perpetual motion. Since the area of the circle could be expressed in terms of the radius and circumference, the problem really became to find geometrically a straight line equal to the circumference, or to find the ratio π between circumference and diameter. [CIRCLE.] Many people, ignorant of the nature of the problem, have believed that they have "squared the circle" in some simple way; but Lambert and others proved—that what was long suspected—that the number π was incommensurable. One geometrical method of approximation is to inscribe a square in a circle and to add one-fifth of the side of the square to three times the diameter of the circle. A curious method adopted by Mr. A. Smith and others was to toss a thin rod many times on a level floor on which a number of parallel lines were drawn at equal distances. If the length of the rod be c and the distance between the lines be d , the probability that the rod will lie across a line is $\frac{2c}{\pi d}$. By actually counting the number of times that this result occurred in 3,200 tosses the value 3.1553 was obtained for π . For a general discussion of the subject the reader is referred to *Mathematical Recreations and Problems* by W. W. R. Bell.

Quadrature, METHODS OF. When the surface whose area is required is bounded by straight lines, the area can be found simply by splitting it up into triangles. [MENSURATION.] The areas of segments of some curves are also easily found;



QUADRATURE.

for example, the area of a parabolic segment is equal to two-thirds that of the triangle whose sides are the chord of the segment and the tangents at its extremities, or four-thirds that of the triangle on the same base, but whose vertex is the point on the curve cut by the diameter, through the point of intersection of the tangents. For any curve the following method is applicable: Divide the base

into a number of equal parts b , and erect ordinates at the points of division. Let ordinates (represented by the dotted lines) also be erected half-way between these others, their heights being h_1, h_2, h_3, \dots . The product $b h_1$ represents the area formed by the figure on base b , whose sides are the two first ordinates produced to meet the fourth side, the tangent at the top of h_1 . Hence the area of the figure $A B C D$ is rather less than $b (h_1 + h_2 + h_3 + \dots + h_n)$ but this expression becomes nearer the true value the smaller we take b . If b is so small that it can be written dx , and the ordinates are different values of y , the expression for the area may be written $\int y dx$ between the limits $y = A B$ and $y = D C$. In some cases this integral cannot be definitely determined, but different methods of approximation can be found. In Simpson's method for determining areas, small parts of the curve are considered as arcs of a parabola, whose axis is taken parallel to the ordinates, the base being divided into an even number of equal parts. A rough approximation to the area of any surface may be obtained by cutting the surface out in uniformly thick paper, weighing it, and comparing it with the weight of a known area.

Quadric Surface is one which can be cut by any straight line in two points. It is, therefore, a surface of the second order, and any plane section of it is a conic, those sections given by parallel planes being similar to each other. The following are examples of quadric surfaces:—

- (1) Ellipsoids including prolate and oblate spheroids, with the sphere as a special case.
- (2) Hyperboloids of one sheet and of two sheets with the cone as a special case.
- (3) Cylinder on elliptic, circular or hyperbolic base, which may reduce to a pair of intersecting planes.
- (4) Elliptic and hyperbolic paraboloids.
- (5) A cylinder on parabolic base.
- (6) A pair of parallel planes.

[ELLIPSOID, PARABOLOID, ETC.]

Quadrille. 1. A card-game, much in favour in the 17th and early part of the 18th centuries. It closely resembles ombre.

2. A square dance, introduced into England from France about 1808. It is so called because the number of couples is four or a multiple of four.

Quadrumanæ, Cuvier's name for an order of Mammals, containing the anthropoids, monkeys, and lemurs. [BIMANA].

Quæstor, the title of a Roman magistrate, whose chief duty, in the later days of the Republic, was the superintendence of the public treasury. It ranked lowest among the great magistracies, and was consequently held by all politicians at the outset of their career. After 421 B.C. plebeians were eligible for the office. In the same year two new quæstors were added to the original couple. The number was increased to eight about 267 B.C., and to 20 in 81 B.C. The quæstors held office for one year, but when it became customary for the consul (or prætor) to be granted a province as proconsul (or proprætor) after the expiration of his term, the

quæstor also retained his position with the title of proquæstor.

Quagga (*Equus quagga*), a striped wild ass, formerly found in immense herds within the Cape Colony, Orange Free State, and part of Griqualand West, but now probably extinct, having been slaughtered for their hides. The head, neck, and upper part of the body were reddish-brown, with irregular dark-brown stripes on the head and neck, gradually growing fainter—the body being nearly, and the hind quarters entirely, self-coloured. In general appearance the quagga resembled the horse more than the ass, especially in the ears and tail; but, like the ass, it had no callosity on the inner side of the hind legs. The name, derived from the shrill barking neigh of the animal, is sometimes given to *E. burchelli*. [ZEBRA.]

Quail, any bird of the genus *Coturnix*, with six species, of the Partridge family, of which they are the smallest members. They range over the Palæarctic, Ethiopian, and Oriental regions to New Zealand. The Common Quail (*C. communis*)—the bird on which the Children of Israel fed in the wilderness—is about seven inches in length, and the female slightly larger, in general form resembling a very small partridge. The plumage is brown with buff markings, and on the throat of the male are two dark-brown streaks descending from the ear coverts, and in the second year they end in a blackish patch. The Quail is a British visitor, arriving in April and generally leaving in November, though some stay through the winter. In their northward migration immense numbers pass over the south of Europe, and multitudes are netted for the market, the flesh being highly valued for the table. Quails are pugnacious birds, and the males are sometimes polygamous. The nest, generally a depression in a green cornfield, contains from seven to fourteen eggs. The young are soon able to follow the old birds, and feed upon grain, insects, and tender leaves.

Quain, JONES (1796–1865), the first of a family of medical men, was born at Mallow. He was for five years professor of anatomy and physiology in London University, and the author of *Quain's Elements of Anatomy*, of which a 10th edition appeared in 1890. His brother, RICHARD QUAIN (1800–87), born at Fermoy, became professor of anatomy and clinical surgery at University College in 1837, and in 1868 was elected President of the College of Physicians. He was also author of several valuable medical treatises (*The Anatomy of Arteries*, etc.), and left a large sum to University College for the encouragement of modern subjects. SIR RICHARD QUAIN, Bart., LL.D., editor of the *Dictionary of Medicine*, a cousin of the above, was born at Mallow in 1816. He was Lumleian lecturer in 1872, Harveian orator in 1885, and President of the Medical Council in 1891, when he was created baronet.

Qualitative Analysis is that branch of analytical chemistry which treats of the determination of the elements present in a chemical, but

does not deal with the quantities. The methods employed are usually the application of a number of tests to a solution of the substance to be examined, the tests being applied in a regular order, so that some of the constituents of the compound are obtained in an insoluble form and so separated. As an example of the methods, if hydrochloric acid be added to a solution of silver, lead and mercurous salts and chlorides of these metals are precipitated. The precipitate is boiled with water, when the lead chloride is dissolved, and filtration leaves only the silver and mercurous salts. Adding ammonia effects the solution of the silver, and leaves the mercurous chloride as a blackened insoluble mass. By filtering again, therefore, the complete separation of the three salts is effected. The filtrate obtained from the hydrochloric is again treated in an analogous manner until all the metals present are determined. Other tests are applied for the acids. Tests in which flame colorations (q.v.) are used are also available, as well as numerous dry reactions in which the salts are heated mixed with suitable reagents. In the case of organic chemistry the qualitative analysis consists for the most part of a number of separate tests to determine the presence of suspected elements.

Quantitative Analysis is the determination of the quantity of all or some of the elements present in a known weight of the compound examined. In inorganic chemistry two methods—*volumetric* and *gravimetric*—are usually employed. In the latter the element required is separated in the form of some compound, usually insoluble, which can be thoroughly dried by heating, and the weight of which can be determined. In the volumetric method use is made of some reaction which takes place on the addition to the solution to be examined of another standard solution, of which reaction the end point can be determined. Thus if an acid has to be determined, a solution containing a known quantity of alkali is added slowly. Some litmus is also placed in the vessel, and is of a red colour, but as soon as the quantity of alkali added is just more than sufficient to neutralise the acid the litmus is turned blue. From the quantity of alkali added then the amount of acid present is determined. In organic analysis the estimation is usually performed by combustion, the carbon and hydrogen being completely oxidised to carbonic acid and water and the weight of these substances determined. Other elements present require other and special treatment.

Quarles, FRANCIS (1592–1644), the quaint religious poet, was a native of Essex. He held the offices of secretary to Archbishop Ussher and chronologer to the City of London. He had no less than eighteen children. His chief poetical work was *Divine Emblemes* (1635), to which was added in 1638 *Hieroglyphikes of the Life of Man: Solomon's Recantation*. The *Enchiridion*, containing aphoristic essays and meditations, was his most popular prose-work.

Quart is a measure of capacity, and is the fourth part of a gallon. It contains about 69·3 cubic inches.

Quarter is a measure of weight. It contains 28 lbs. avoirdupois, and is the fourth part of a hundredweight. It is also used as a measure of capacity, being equivalent to eight bushels.

Quartz, the anhydrous mineral form of silica or silicon-dioxide (SiO_2) crystallising in the Hexagonal system. It is sometimes extended to all forms of silica, including the non-crystalline chalcedony (q.v.), and jasper (q.v.), and even the hydrous opal (q.v.). The crystalline variety is 7 in the scale of hardness, and has a specific gravity of 2·6. Its most common crystalline form is the hexagonal prism terminated by six-sided pyramids. When colourless and transparent, it is known as *rock-crystal*, *Brazilian pebble*, *Irish diamond*, etc.; when violet, as *Scotch amethyst*; when smoky, as *cairnngorm*. It also occurs rose-coloured; or milky, from the numerous cavities containing salt-water or liquid carbon-dioxide. All crystalline varieties break with a conchoidal fracture. It is one of the most abundant minerals, being an essential constituent of granite, eurite, felsite, liparite, gneiss, and mica-schist, and forming almost the whole of quartzite, sand, and sandstone.

Quartzite, a very hard, compact, granular rock, seldom schistose, but occasionally fossiliferous, which occurs among the older sedimentary rocks, and is, in most cases, obviously an altered sandstone. It differs from the harder sandstones such as sarsen-stone (q.v.) only in showing when under the microscope signs of the partial fusion of some of its constituent quartz-grains. In some cases there is evidence of induration having resulted from the transfusion of heated silicated water rather than from dry heat or pressure.

Quassia, a bitter febrifuge wood originally obtained from *Quassia amara*, a lofty tree of Surinam belonging to the order Simarubaceæ, closely allied to the rue tribe. It is now mainly obtained from the allied *Picræna excelsa* of Jamaica. It is carved into "bitter cups" which give a taste to water, and is said to be used as a hop-substitute in brewing. Upon the lower animals it has a narcotic effect.

Quaternary Period, the name applied to the Pleistocene (q.v.) by those who consider that the appearance of man is sufficient to distinguish the more modern rocks as one of the primary divisions of the stratigraphical series. Others treat it merely as a continuation of Tertiary time.

Quaternions were invented by Sir William Hamilton as a mathematical method of dealing with directions in space without the use of the arbitrary axes of Cartesian geometry. A quaternion itself is the factor or operator which changes one directed line (or vector) into another. Quantities which do not include direction are known as scalar, and any vector can be regarded as the product of unit vector (which gives the direction) and a scalar quantity. If a vector be rotated into a new direction, the operator is known as a versor, and therefore this versor must imply the existence of

an axis and a definite angle. Suppose a vector, β , in the plane of the paper be rotated into a direction at right angles, also in the plane of the paper; the axis of the versor must be perpendicular to the plane of the paper, and if i be this versor, $i\beta$ is the new vector. If this new vector be called j , we have the equation $i\beta = j$. We can again turn the vector through a right angle also in the plane of the paper and have $i^2\beta = ij = -\beta$, since the new vector is in the opposite direction to the original. This gives us

$$i^2 = -1, \text{ or } i = \sqrt{-1}.$$

It was by endeavouring to give a real geometrical meaning to the algebraical symbol $\sqrt{-1}$ that Sir William Hamilton was led to his calculus of quaternions. Eventually he was led to the adoption of three units in space, which he called i, j, k , and which fulfilled the following conditions:

$$\begin{aligned} i^2 &= j^2 = k^2 = -1 \\ ij &= -ji = k \\ jk &= -kj = i \\ ki &= -ik = j \end{aligned}$$

Working from these assumptions, he was enabled to greatly simplify the calculations and expressions of space geometry, and his calculus has found unlimited application in the domain of theoretical physics.

Quatre-Bras, a village in Belgium, 10 miles S.E. of Waterloo, at the point where the roads from Brussels to Charleroi and Nivelles to Namur intersect. Here, on June 16, 1815, the allied forces under the Duke of Brunswick, the Prince of Orange, and Sir Thomas Picton met the French under Ney in an obstinate conflict.

Quatremère, ÉTIENNE MARC (1782-1857), Orientalist, was born in Paris, where he worked in the Imperial Library. He was successively professor of Greek in the College of Rouen, of ancient Oriental languages at the Collège de France, and of Persian in the School for Modern Oriental Languages. His chief work was *Recherches sur la Langue et la Littérature de l'Égypte* (1808); he also translated Makrizi's *Arabie History of the Mamelukes*, and Rashid-ed-Din's *Persian History of the Mongols of Persia*.

Quebec, until 1867 known as Lower Canada, is the largest and most easterly of the two provinces of the Dominion, being bounded N. and E. by Labrador and the Gulf of St. Lawrence, S. and E. by the same gulf, New Brunswick, and the United States, and W. by the province of Ontario, and having an area of 188,694 square miles. The coast-line of nearly 2,000 miles offers numerous safe harbours, and the countless islands—of which Anticosti, the Magdalens, Bonaventure, Montreal, St. Helens, Calumet, and Allumette are the chief—provide convenient fishing-stations. In the valleys the soil is extremely fertile, yielding good crops of cereals, hay, roots, and fruit; there is excellent pasture also, and the mountains are covered with valuable forests of pine, ash, elm, hickory, and walnut. Gold, iron, and copper exist in considerable quantities, and good building stone is

plentiful. Quebec is the capital, but Montreal is the largest city, other towns of importance being Three Rivers, Levis, St. Hyacinthe, Sorel, St. Johns, Hull, St. Henri, and St. Jean Baptiste. Quebec was colonised by France in 1608, and taken by the British in 1759-60, the French Catholics (who form the bulk of the population) being guaranteed the enjoyment of their laws and religion by the Quebec Acts of 1774. The province returns 65 members to the Dominion House of Commons and 24 to the Senate.

QUEBEC, the capital of the province and formerly of all Canada, stands on the N. bank of the St. Lawrence, at the mouth of the St. Charles, 300 miles from the sea and 180 miles below Montreal. The docks are among the finest in the world, accommodating the largest vessels and being extended to the opposite shore of the river at Levis. Among the public buildings may be mentioned the Governor's residence, with the monument to Wolfe and Montcalm, the Anglican cathedral, and Laval University. The supply of water from Lake Charles is excellent. Railways communicate with all parts of the Dominion and the United States, and steamers ply to Europe and the American ports. The timber trade is the chief source of wealth, but a large share of the general imports and exports passes through Quebec, which possesses, too, some local industries, such as iron-founding, the making of cutlery and nails, leather-dressing, and indiarubber manufacturing. The city is governed by a municipal body, and returns three members to the Canadian Parliament and three to the Provincial Assembly.

Quebracho, the name applied to various hard woods containing tannin which are used for tanning and dyeing in South America. *Quebracho blanco*, containing 14 to 16 per cent., is *Aspidosperma Quebracho*, and is exported to France. *Quebracho rubio*, *Loxopterygium Lorentzii*, from the River Plate, is too hard for easy use. *Quebracho flojo* is *Iodina rhombifolia*, and *tipa* is *Macharium fertile*. We only import a few hundred tons.

Quedlinburg, an old town of Prussian Saxony, on the river Bode, to the N.W. of the Harz Mountains. In the crypt of the abbey-church, dating from the 10th century, lie the remains of the founder, Henry the Fowler. Quedlinburg is the centre of a great gardening district, whence seeds of all kinds are exported to every part of the world.

Queen, a word common to several Teutonic languages in the sense of "woman" or "wife" (Gothic *qens* and *qino*, Anglo Saxon *cwén*, Icelandic *krán* and *kona*; cf. Greek *gunē*). *Quean* is merely another form of the same word. In Anglo-Saxon "queen" came to be used of the king's wife only. In Wessex, however, *hlæfdige* ("lady") was the more usual term. "Queen" is the word employed in speaking of Matilda, wife of William I. and other royal consorts of the Norman and Plantagenet dynasties; but it is never applied to the Empress Matilda, who claimed the crown in her own right. It is now used alike of the queen-consort, the queen-dowager (the widow of the late king), and

the queen-rènant. Owing to the doubts which still lingered as to whether a woman could reign in England, it was found necessary on the accession of Mary Tudor to pass a statute declaring that the queen-regnant has the same powers and prerogatives as a king. By the Act 25 Edward III. it was made treason to compass or imagine the death of the queen-consort or to violate her person; and, if the queen gave her consent to the latter, she herself committed treason. The legal position of a queen-consort is that of a *feme sole* and not of a *feme covert*, so that she may purchase and convey lands or sue or be sued apart from her husband.

Queen Anne's Bounty was established in 1704 for the purpose of aiding the poorer clergy. The fund was derived from the proceeds of the tax called annates or first-fruits (consisting of the first year's income of every living) and also that which exacted the tenth portion of the income in subsequent years. These taxes, originally levied by the Pope, had been appropriated by the king at the Reformation. Their administration was now placed in the hands of a corporation comprising various ecclesiastical, legal, and other dignitaries. The revenue in 1890 amounted to £176,896.

Queen's College, an institution in Harley Street, London, for the higher education of women, founded in 1848 and incorporated by royal charter in 1853. After a preparatory course at a school for pupils under 14 the students remain at college three years if they seek the grade of *associate*, and six years or longer if they aim at becoming *fellows*.

Queen's Counsel. [BARRISTER.]

Queen's County, deriving its name from Queen Mary, is situated in the province of Leinster, having King's County to N. and W., Kildare and Carlow to E., Kilkenny to S., and Tipperary to S.W. Its area of 663 square miles is mainly level, but the Slieve Bloom Range in the N.W. and the Dysart Hills in the E. cause some diversity. A few woollen and cotton goods are manufactured, and coal, iron, manganese, potter's clay, and slate are worked profitably, though on a small scale. Maryborough is the capital.

Queensland, the most northerly of the Australian colonies, occupies an area of 669,520 square miles in the N.E. corner of the continent, being bounded N. by Torres Strait, S. by New South Wales, E. by the Pacific, W. by the Gulf of Carpentaria, Northern Territory, and South Australia. It grew out of the penal settlement at Moreton Bay, and received independence in 1859. The Pacific coast possesses many good harbours, *e.g.* Brisbane (the capital) in Moreton Bay, Maryborough in Wide Bay, Gladstone on Port Curtis, Rockhampton in Keppel Bay, and Cardwell in Rockingham Bay. Most of these are protected by the Great Barrier Reef. The only good port on the other side is at Point Parker. Rivers are plentiful, though not large. The Logan, Brisbane, Mary, Burnett, Fitzroy, Burdekin, Hubert, and Endeavour fall into the Pacific, and the Mitchell, Flinders, Leichhardt, and Albert drain into the gulf. Of lakes there are few. The climate, though hot, is healthy and

bracing on the higher levels. Pastoral farming was, and still is, the chief industry, millions of sheep and cattle finding nourishment on the wide treeless table-lands. Of the mineral resources coal is the most important, the fields extending over 24,000 square miles. Great quantities are exported from the Newcastle, Ipswich, and Bundaberg districts. Gold is found in many parts, but the output has fallen off lately. Silver, copper, tin, iron, and the rarer minerals are abundant, and only await labour for their exploitation. The pearl and trepang fisheries off the coast of York Peninsula yield profit, and the supply of ordinary fish is excellent. The sugar cane is much cultivated by Kanaka (q.v.) labour, besides coffee, rice, and other tropical products. Manufacturing industries are as yet in their infancy. As the tropical and temperate parts of the colony differ widely in their economic and political conditions, there has been of late years an active movement in the former for their separation.

Queen's Metal is an alloy resembling Britannia metal, but containing lead in place of some of the tin or antimony of that substance. It is hence cheaper, but inferior in quality, and is very commonly used for the production of jugs, culinary articles, etc.

Queenstown, formerly COVE OF CORK, is a seaport on the south shore of Great Island, 14 miles S.E. of Cork. Here the principal ocean-going steamers call on departure for or arrival from America. The present name was given on the occasion of the Queen's visit in 1849. An excellent harbour, with an area of eight square miles, is strongly defended by forts and batteries.

Quercite is a compound of the composition $C_6H_{12}O_5$. In certain points it resembles the sugars which are usually found with it in the chief source of the compound, *i.e.* *acorns*. Thus it has a sweet taste and is easily soluble. It has been shown to belong to the benzene series of compounds and to be represented by the formula $C_6H_7(OH)_5$, being an addition compound of benzene.

Quercitron, the inner bark of a North American species of oak, *Quercus tinctoria*, the "Black Oak," which is used as a yellow dye.

Queret  ro, a state and city of Mexico, North America. The former has an area of 3,400 square miles, occupying a central plateau of the Cordilleras and being broken up by rugged mountains. The valleys are fertile, producing grain and cotton, and feeding large numbers of sheep and cattle. Gold, silver, antimony, mercury, and other metals are worked, but not on a great scale. The city stands high, and is connected by railway with Mexico, 152 miles distant. The Hercules cotton-mills are the largest in the republic, and the woollen, leather, soap, and wood-carving industries also prosper. The Emperor Maximilian (q.v.) was executed here in 1867.

Quern, a primitive hand-mill for grinding corn. It was usually formed of two flat circular stones, the upper being attached to the lower by means of a pin of wood or metal on which it revolved. The upper stone contained two holes, one in the centre,

into which the grain was dropped, and a smaller one near the rim to hold the stick used in turning it. Querns have been found in all parts of Europe which were inhabited by primitive peoples, including the lake-dwellings of Switzerland. They are still used in the Hebrides, the Shetlands, and the less-frequented parts of Ireland.

Quesnay, FRANÇOIS (1694-1774), a French physician, born at Mérey, was the chief of the school of political economists called the Physiocrats. Besides important articles in the *Encyclopédie*, his doctrines were set forth in *Tableaux Économiques* (1758), copies of which are very rare, even if they exist, and in other works, such as *Maximes Générales du Gouvernement Économique d'un Royaume Agricole*, which are accessible.

Quesnel, PASQUIER (1634-1719), Jansenist theologian, was educated at the Sorbonne, and, when quite young, appointed director of the Paris house of the Congregation of the Oratory. His edition of the works of Leo the Great was placed in the *Index Expurgatorius* for its Gallican tendencies, and in 1684, refusing to abandon Jansenism, he had to flee to the Low Countries. His celebrated *Réflexions Morales sur le Nouveau Testament*, begun in Paris, were continued and published in Brussels, but condemned by the Bull "Unigenitus;" their author died at Amsterdam, whither he had fled from Jesuit persecution.

Quetelet, LAMBERT ADOLPHE (1796-1874), Belgian astronomer, was a native of Ghent. In 1828 he became director of the Brussels Observatory, and in 1834 perpetual secretary of the Belgian Académie Royale, to whose publications he made important contributions. In his works, the chief of which was *Sur l'Homme et le Développement de ses Facultés* (1835), he gave much attention to the doctrine of probabilities in its practical aspects. His last important work, *L'Anthropométrie*, appeared in 1871.

Quevedo Villegas, FRANCISCO GOMEZ DA (1580-1645), a Spanish writer and diplomatist, was born at Madrid. He made a great name as a scholar at the university of Alcalá, but in 1611 was obliged to leave Spain in consequence of a duel. Under the Duke of Ossuna, when Viceroy of Sicily and Naples, he showed much diplomatic and financial ability, but was involved in his fall in 1619. In 1623 he came to the court of Philip IV., whom he tried to dissuade from government by favoritism, attacking the system in his *Politica de Dios* (1626) and *Hell Reformed* (1628), but was at length overthrown by the Count Duke of Olivarez and imprisoned in a convent at Leon from 1639 till the fall of the minister four years later. His health was completely broken by this imprisonment, and he only survived his liberation two years. Quevedo wrote much on various subjects, and was especially known as "the scourge of silly poets." His own verse was published without his consent; but he discovered and published the works of the poet Francisco de la Torre, which were for a time thought to have been his own. Among his prose writings *El Vida*

del Buscon Pablos (1626), a novel, and five *Visions* (of which an English version appeared in 1667 by Sir R. L'Estrange) should be mentioned. Unfortunately we have the latter only in a very corrupt form, and not as the author wrote them.

Quiché, one of the civilised nations of America, akin to the Mayas (q.v.), and forming with them the Maya-Quiché family. The Quichés formed, and still form, the bulk of the population in Guatemala, where they are divided into several distinct groups, such as the Cakchiquels, Zutugils, Chorti, Ixils, Chañabals, Chols, Aguacatecs, all speaking dialects of the Quiché mother-tongue. This is one of the few American languages which possesses a literature which includes the *Rabinal Achi*, a native drama, and the famous *Popol-Vuh*, containing the national histories, myths and traditions of which the text, with French translation, was published in Paris (1861) by the Abbé Brasseur de Bourbourg.

Quichuas, the chief civilised people of South America, who with the kindred Aymaras occupied the whole of the Andean plateaux from Cuzco to Lake Titicaca, i.e. most of the present states of Ecuador, Peru, Bolivia, and Chili, south to the river Maule, on the Araucanian frontier. The Quichuas formed the bulk of the population of the empire of the Incas, under whom they arrived at a high degree of culture, as attested by their numerous temples and other monuments, their great highways, irrigation works and cultivated lands, carried by means of banked-up terraces high up the slopes of the Cordilleras. They were skilled especially in the arts of weaving, dyeing, and pottery, and were able to record events by the so-called *quippos*. They embalmed the dead, and deposited with them the objects they most valued in life. Multitudes of these objects have been found in the graves at Ancon, near Lima, and elsewhere, throwing a flood of light on the social system, arts, industries, and general culture of the Quichua people. The Quichua (properly Inca) language was highly cultivated, and many of the national songs, dramas, and legends, handed down orally, have since been published. The language is highly polysynthetic.

Quick-firing Gun, a gun which is furnished with a metal case known as a *quick-loader*. It is attached to the rifle near the breech, and has a spring which pushes up the cartridges in rapid succession.

Quicklime consists of the oxide of calcium, CaO. It forms a white mass which is very infusible, and if heated strongly glows with a bright white light. It is hence used largely for forming the lime cylinders for limelight and for making the furnaces for fusing platinum. It unites with water with great avidity, much heat being evolved by the combination, which results in the formation of *slaked lime*, CaO₂H₂. Lime is also used for a very great number of technical and ordinary uses too diverse and well known to need enumeration.

Quicksilver. [MERCURY.]

Quietism, a form of Mysticism (q.v.), which consists in suppressing all intellectual activity, and, indeed, all consciousness of self and the external world, so that the soul becomes absorbed in the

contemplation of the Divine Being. Quietism closely resembles other forms of Mysticism, but the Quietists attached even less importance to the practical virtues than is usual with Mystics generally. The founder of this religious school was the Spanish theologian Molinos, whose *Spiritual Guide* was published in 1675. From Spain Quietism passed to France, where its chief exponents were Madame de Guyon (q.v.) and the saintly Archbishop Fénelon (q.v.). The "Confessions of a Beautiful Soul," in Goethe's *Wilhelm Meister*, are a well-known illustration of it.

Quill, a term applied (1) to the hollow cylinder at the base of the shaft of a feather; and (2) to any of the larger wing feathers. Those of the goose, turkey, and swan were formerly the only material of writing-pens in the West, though the manufacture of quill pens has lost its importance since the introduction of steel pens. Pens made from crow quills are still used for drawing, and the name is given to a fine steel pen.

Quin, JAMES (1693–1766), the actor, came of an Irish family, and made his *début* on the Dublin stage. In 1716 he made his reputation at Drury Lane in the part of Bajazet in *Tamburlaine*. Having played for several years at Rich's Theatre, Lincoln's Inn Fields, and been temporarily under a cloud on account of having killed another actor in a duel, he returned to Drury Lane in 1734. Here he acted till 1751, after which he lived in retirement at Bath. He was eclipsed in his later years by Garrick, with whom he appeared, together with Mrs. Cibber, in 1746, in the *Fair Penitent*. Quin was an intimate friend of Thomson, the poet.

Quince (*Cydonia vulgaris*), a tree belonging to the sub-order Pomaceæ, of the rose tribe, with leafy calyx-lobes and more than the two seeds in each division of the core, which are characteristic of *Pyrus*, the genus to which apple, pear, and mountain ash belong. It is a native of the Mediterranean region, flowers in May or June, and bears a large golden-yellow fruit of variable form, fragrant odour, but, when raw, of austere flavour. It is cooked with apples, and was the original ingredient of marmalade, *marmelo* being the Portuguese name of the fruit. The quince is used as a stock on which to graft pears.

Quincy, a city in the state of Illinois, United States of America, standing on a high bluff of the east bank of the Mississippi, 160 miles north of St. Louis. Having a good river harbour, and being an important railway centre, the place is exceedingly prosperous. It contains ironworks, woollen- and paper-mills, and factories for making agricultural implements and sewing-machines.

Quincy, JOSIAH (1772–1864), an American statesman, born at Boston, was elected to Congress in 1804, and became one of the chief orators of the Federal party. He denounced slavery and opposed the admission of the western states into the Union. After 1812 he retired from Congress, but took part in the affairs of Massachusetts, and was for five years mayor of Boston. He was also president of Harvard University from 1829 to 1845, and wrote a

history of the university and of Boston, as well as lives of his father and of John Quincy Adams.

Quinet, EDGAR (1803–75), the friend of Michelet and Cousin, was born at Bourg, in the department of Ain. His first book, *Les Tablettes du Juif Errant*, was published when he was only 17. Two years later he translated Herder's *Philosophy of History*. He travelled in Germany, Italy, and England in his early years, when he also wrote poems. In 1838 appeared his *Examen de la Vie de Jésus*, in which he pointed out the shortcomings of Strauss. His own religious feeling was revealed in his Lyons lectures, which were published under the title of *Du Génie des Religions*, in 1842, and in his attacks on the Jesuits. His lectures at the Collège de France so excited the public mind that they were prohibited by Government in 1846. Quinet took part in the revolution of '48 and represented Ain in the Assembly; but after the *coup d'état* had to live in Belgium and Switzerland. Returning to Paris in 1870, he sat in the National Assemblies at Bordeaux and Versailles, and signalled himself by his patriotic speeches. Besides the books mentioned, he wrote *Histoire de mes Idées* (1860) and several historical and imaginative works.

Quinine is one of the most important of the group of compounds known as the *alkaloids*. It occurs largely together with an allied alkaloid known as *cinchonine* in *cinchona bark*. It is found in the greatest quantity—2 or 3 per cent.—in the variety known as yellow bark, *Cinchona calisaya*, and may be extracted by suitable solvents. The exact methods of extraction and details of process by which the compounds are commercially obtained are kept to an extent as trade secrets. Quinine in its chemical deportment behaves as a basic substance, uniting with acids to form salts. Of these, sulphate of quinine is that which is commonly used, and the form in which quinine is almost universally used. The alkaloid itself has the composition $C_{20}H_{24}N_2O_2$, and crystallises in needle-shaped crystals, melting about 137° and possessing a bitter taste. The sulphate has the composition $(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 8OH_2$, and forms shining needle-like crystals slightly soluble in cold water and more easily in hot. It dissolves readily in dilute sulphuric acid, and the solution is distinguished by being fluorescent, having a fine blue fluorescent tint. Quinine can be readily detected by the beautiful green coloration produced when chlorine water, followed by ammonia, is added to the compound or its solution. Its chemical constitution is not yet satisfactorily determined, but it appears to be a quinoline derivative. The sulphate of quinine is often given in one-grain doses as a tonic, and in larger doses in fevers or malaria. Quinine is often administered in the form of the compound citrate of iron and quinine, the dose of which drug is from five to ten grains for an adult. The Pharmacopœia contains, moreover, a pill, tincture, ammoniated tincture, and wine of quinine, and several preparations of bark, of which the best known is the *Tinctura Cinchonæ Composita*. Quinine is a valuable tonic; it reduces the temperature of the body, and it is a direct specific for the

treatment of ague. It is liable when administered in large doses to produce headache, deafness, singing in the ears, and other symptoms; to this condition the term "Cinchonism" is applied.

Quinol. [HYDROQUINONE.]

Quinoline is an organic compound of the composition C_9H_7N . It occurs in coal-tar, bone-oil, and may be prepared by numerous reactions. It appears to consist chemically of a benzene (q.v.) and pyridine ring united together by two common carbon atoms. It is a colourless liquid and possesses a powerful and penetrating odour. It has a specific gravity of 1.095, and boils about 239° . In its chemical behaviour it acts as a basic substance, uniting with acids to form compounds analogous to salts. It forms a large series of derivatives, formed by the replacement of some of the hydrogen by other elements. As this substitution can take place in either the benzene or the pyridine ring, there are a very great number of isomeric forms. It has of late years derived very much additional interest from the fact that many of the alkaloids and other compounds possessing tonic properties appear to be derivatives of quinoline or of an isomeric substance termed *iso-quinoline*.

Quinone. The term quinone is a general one applied to all benzene derivatives in which two oxygen atoms take the place of two atoms of hydrogen. According to the relative position, different classes of quinones exist. When no prefix is added, however, quinone generally means *Benzo-quinone*, a compound of composition $C_6H_4O_2$, which is obtained by the action of oxidising agents upon aniline and other benzene compounds. It forms crystals of golden yellow colour, which melt at 116° , has a peculiar odour, and is easily soluble in all ordinary solvents. By reduction it yields the compound *hydroquinone*, which is largely employed as a developer in photography.

Quinsy (Greek, *cynanche*), inflammatory sore throat. [TONSILITIS.]

Quintana, MANUEL JOSE (1772–1857), Spanish poet, was the author of *Vidas de los Españoles Celebres*, some tragedies, and especially some stirring patriotic odes. His Liberal opinions caused him to be imprisoned for six years, but he afterwards modified them, and even held office.

Quintana, in the Roman camp, the name given to the street which occurred at intervals of each five *turmæ* or *manipuli*.

Quintilian (MARCUS FABIVS QUINTILIANUS), was a native of what is now Calahorra, Spain. He was educated in Rome, whither in 68 he returned with Galba to practise in the law courts. He gained an even greater reputation as a teacher of oratory than as a pleader, and had Pliny the Younger as a pupil. He enjoyed the favour of several successive emperors, and under Vespasian received a salary from the state. After his retirement from public life he wrote *De Institutione Oratoria*, a treatise in 12 books, remarkable alike for its learning, its purity of style, and its good sense. The tenth

book contains an admirable survey of Greek and Roman literature. Quintilian died about the year 97, aged somewhat over sixty.

Quito, the capital of the republic of Ecuador, South America, is the highest city of its size in the world, standing on the east slope of Mount Pichincha, 9,520 feet above sea-level. The Jesuit's college and university, the cathedral, the Government buildings, and the palace of the nuncio are the only structures of importance. Earthquakes have frequently devastated the place. Iron and steel goods, indigo, and agricultural produce form the chief exports; but, as Quito has but scanty means of communication with the outer world, trade languishes. Cotton and woollen goods, silk, lace, thread, jewellery, and confectionery are produced for home consumption.

Quoits, a game which consists in throwing a flat ring of iron at some fixed object. It is usually played between two iron pins called "hobs," which are fixed in the ground about nineteen yards apart, the object of the thrower being to make his quoit fall in such a position that the hob shall be surrounded by the ring. This secures a double score, the scoring being otherwise regulated in the same way as in bowls. The antagonists may be either single players or several players arranged in two sides. Each player throws two quoits, the diameter of which is limited by rule to eight inches, the weight being undetermined. After each round the players remove to the opposite hob. In throwing it is necessary to give the quoit a slightly rotary motion by means of the wrist.

Quorum originally denoted those justices of the peace in whose absence trials could not be held. The expression arose through the manner in which commissions were worded; it is stated (in Latin) that the body in question is to consist of certain members, *quorum unum A. B. esse volumus* ("of whom we will that A. B. be one"), or some such phrase being added. The term now merely denotes the number of persons belonging to any body who must be present in order that business may be transacted.

R.

R, the eighteenth letter of the English and the seventeenth of the Latin alphabet, derived through the Greek ρ from the Phœnician *Resh*. It is classed as a semi-vowel or liquid. In most languages, and even in Central and Southern English, before vowels it is a trill or broken murmur produced by raising the tip of the tongue up close to the palate, and making it vibrate by an emission of voiced breath and then lowering the tongue-tip. There are several varieties of this sound, of which the ordinary English variety is the weakest, being either a slight murmur or quite suppressed before consonants, or when final, as in *art*, *ever*; but in these positions, and sometimes also when followed by mute *e*, the preceding vowel is modified, as in *pert*, *first*, *curd*, *word*, *horse*, *per*, *fir*, *fur*, *for*, *here*, *pure*, *sore*, *care*, while *a* before *r* and a consonant, or accented before final *r*, retains its old open

sound, and *ar* = *ā*, as in *art*, *harm*, *farce*, *guitar*. The *r grasséyé* is formed by the vibration of the uvula and velum pendulum. The same sound is given to *rr* as to *r*; e.g. *carrot*, *carol*, *ferry*, *very*, *florid*, *torrid*, *card*, *charred*. In several languages—e.g. in English and Latin—*r* has succeeded a voiced sibilant (English *z*), as in *hare* for Teutonic *haza*.

Rabanus (HRABANUS), surnamed MAURUS by Alcuin, his master, was born at Mainz about 775, and died in 856. He became Abbot of Fulda in 822, and Archbishop of Mainz in 847. He was author of several learned works, such as *De Universo, sive Etymologiarum Opus*, and a Latin-German glossary to the Bible.

Rabat, RIBAT, ARBAT, BRAT, or NEW SALLEE, is a fortified port of Morocco, 130 miles south of Cape Spartel, at the mouth of the river Bu Bakrak. A great many European imports pass hence into the interior, and the wares of the country, such as carpets, pottery, brasswork, etc., are exported to northern markets. Sallee, on the other side of the river, is now a poor place. It was formerly the starting-point of the worst piratical marauders.

Rabbi, RABBIN (from French), a title of dignity (Aramaic, *rabbī*, “my master,” “my lord”) given to doctors of Jewish law, properly to those who are ordained for the performance of certain legal and sacerdotal functions; loosely applied to distinguished Jewish Hebraists, and to any minister in a Jewish congregation. Sometimes the less dignified *rab* (“master,” “lord”) is similarly used.

Rabbit (*Lepus cuniculus*), a well-known British rodent, of the same family and genus as the Hare (q.v.), from which it differs in its smaller size, greyer coloration, and smaller black patch at the tips of the ears, and the fact that the hind limbs are not so much longer than the front pair. The condition in which the young are born also forms a sharp distinction between the two. Those of the rabbit come into the world blind, naked, and quite helpless, and are brought forth in a burrow which the mother digs for that purpose, and lines with fur plucked from her body. Those of the hare are clothed, and can see when born. Hybrids between the hare and the rabbit are fertile, and are said to be fertile with either of the parent species. The home of the rabbit is generally supposed to be Spain, or at any rate the western part of the Mediterranean basin, whence it has spread northwards through the temperate parts of Western Europe. The cold of Scandinavia and North Russia has prevented these animals finding a home in those regions. In England it is common enough. It was not introduced into Scotland and Ireland till quite recent times, but owing to its fecundity, which is proverbial, it has spread over both the sister kingdoms. Rabbits begin to breed when about six months old, and there may be from four to eight litters in a year, with rarely less than three, and sometimes as many as eight in a litter.

The most notable instances of the rapid spread of this animal, and the damage occasioned thereby, are to be found in Australia and New Zealand,

where wild rabbits were turned out somewhere about the middle of the nineteenth century. In a short time they multiplied to such an extent as to become veritable pests, eating and spoiling the sheep-feed, and thereby seriously injuring the sheep-farmers. Many expedients have been tried to keep down their numbers. Traps, poison, and the virus of fowl-cholera, have been tried, but these remedies together have done little to mitigate the scourge. New South Wales alone spends about £100,000 a year in endeavouring to cope with the rabbit plague. The turning-out of weasels and stoats has been suggested, but the remedy might be worse than the disease. Local varieties of the rabbit occur in the Falkland Islands and in Jamaica. In Porto Santo, one of the Madeiras, is a dwarf-race, the limb-bones of which are little more than half the size of those of an English wild rabbit.

Wild rabbits are social animals, and on light sandy soils their burrows are very numerous, and a tract of ground where such burrows exist is called a warren. They feed on grass, herbs, green crops, and the tender bark of young trees, and, where they abound, inflict considerable loss on farmers and market-gardeners. In some cases rabbit-farming seems to have been profitably carried on. The fur is used for hat-making, and the flesh is valued for food. Besides the large quantities sent from the country to London, it is estimated that considerably over 100 tons a week are shipped to England from Ostend during the winter. These last are tame rabbits bred in hutches by the Belgian peasantry. It would seem as if this cottage industry might be advantageously introduced at home.

Domesticated rabbits have run into a great number of varieties, amongst which is an albino race, with red eyes, as firmly established as is its natural enemy, the ferret. Tame rabbits are easily kept, and breed freely in confinement. Cleanliness, dry hutches, and a mixture of hard with green food, are the principal points to be borne in mind in order to ensure success. Opinions differ as to giving water to tame rabbits; the need for it depends greatly on the nature of the food, but does, after bearing young, should have a supply.

Rabelais, FRANÇOIS, the great French humorist, is traditionally said to have been born at Chinon, the son of an apothecary or tavern-keeper. The dates of his birth vary between 1483 and 1495. He is certainly known to have been a brother of the Franciscan house at Fontenay-le-Comté, in La Vendée, which in 1524 he left for the house of his friend Bishop Geoffroy d'Estissac at Maillezais. Though henceforth nominally a Benedictine monk, he was allowed by Pope Paul III. to practise medicine, which he studied at Montpellier. Here he graduated and lectured on Galen and Hippocrates. The most fruitful period of his life was that which Rabelais spent at Lyon (1532–35), where he frequented the society of Dolet and Despériers and produced his masterpieces. He next became physician to Cardinal Jean du Belloy (with whom he is said to have been at school), and went with him to Rome. He afterwards entered the service of Du Belloy's elder brother. After a period of

disgrace, during part of which Rabelais practised as a physician at Metz, he gained court favour by a letter to the Cardinal de Guise, to whom he wrote an account of the birth of the second son of Henri II. He was then appointed *curé* of Meudon, which, however, he resigned in two years. He is believed to have died at Paris in 1553. Rabelais is supposed to have edited *Les Grandes et Inestimables Chroniques du Grand et Enorme Géant Gargantua*, which appeared at Lyon in 1532. The first book of *Pantagruel* was published in 1533; but it is not certain whether the real *Gargantua* preceded or followed the latter. These works appeared under the name Alcofribas Nasier. The third book, specially licensed by the king (Francis I.), followed in 1546, and the fourth in 1552. They were afterwards condemned by the Sorbonne, and the sale was for some time suspended by the Parlement. Under allegorical stories of much learning and humour, but great coarseness, they convey wise condemnation of prevalent ecclesiastical and educational abuses.

Rabies. [HYDROPHOBIA.]

Raccoon, RACCOON, any animal of the American genus *Procyon* of the bear-like section of Carnivores, with two or three species. The common form or "coon" (*P. lotor*) is North American, and derives its specific name from its habit of dipping its food in water. It is about the size of a large cat, with long brown hair, and bushy tail, marked with dark rings. Raccoons are nocturnal and arboreal, descending from trees only in search of food—chiefly aquatic animals and corn—and hibernating in winter.

Raccoon-Dog, Raccoon-Dog. [DOG.]

Raceme (from the Latin *racemus*, "a bunch of grapes") is the term applied in botany to a type of inflorescence (q.v.) in which the main axis or podium is elongated, its terminal bud being the last to unfold, whilst lateral buds succeed one another *indefinitely* and *acropetally*. A *simple raceme* has but one order of branches, as in the mustards, cresses, and most Cruciferae (q.v.); the bunch of grape-blossoms, being repeatedly branched, is a *compound raceme*. The *spike* (q.v.) differs only in its sessile flowers. When the lower flowers have longer pedicels, so as to bring them to a level with others produced later, the raceme is *corymbose*, as in the wall-flower. When the flowers are all borne on one side of the axis, it is a *dorsiventral raceme*, and will often become *scorpioid*, as in forget-me-not. The raceme may be *dense*, with flowers closely ranged, or *lax*, with them wide apart; *bracteate*, as in the wild hyacinth, or *ebracteate*, as in the Cruciferae.

Racemic Acid is an acid, isomeric with tartaric acid, being represented by the same formula, $C_4H_6O_6$. It appears to consist of two isomerides, which act upon polarised light to an equal extent, but in opposite directions, so that the racemic acid is optically inactive. [POLARISATION.] It may also be split up by suitable means into the two forms, and, owing to the peculiar form of isomerism, the term *racemates* has been extended to all such

compounds, *i.e.* inactive isomers which owe their inactivity to the presence of two optically active isomers in equal proportions. In its chemical character it resembles tartaric acid in almost all particulars. [TARTARIC ACID.]

Rachel, MADAME (ÉLISA RACHEL FELIX), the great actress, was born in Aargau, Switzerland, in 1820 or 1821, her parents being Alsatian Jews. She and her sister sang in the streets of French cities, and were taken up by Choron, a well-known teacher of music. Élisabeth gained her first great success in 1838 at the Théâtre Français, in *Les Horaces*, after which she carried all before her. Her chief rôles were taken from the tragedies of Corneille and Racine, *Phèdre* (first played by her in 1843) being a magnificent example of the pathetic. She also acted with great success in some modern plays, particularly in *Adrienne Lecourreur*. In 1840 Rachel was well received in London, and she afterwards appeared in the chief Continental cities. She died near Cannes in 1858.

Rachis, now sometimes spelt, more strictly in the Greek form, *rhachis*, is an axis of any kind; but is used most generally for the prolongation of the leaf-stalk or petiole in a compound leaf beyond the lowest leaflets, thus corresponding to the midrib of a simple leaf. A simply pinnate (q.v.) leaf will have but one rachis; but in a bi-pinnate leaf there are *secondary rachides* as well as the *primary* one; and there may similarly be *tertiary rachides*.

Rachitis. [RICKETS.]

Racine, JEAN (1639–99), was born at La Ferté-Milon, department of Aisne, his father being a *procureur* (solicitor). He was educated at Beauvais and at Port Royal, and was for a time assistant steward to the Duc de Luynes. For some time he led the life of a young man of pleasure at Paris, and in 1661 his relations had him sent to Uzès. Two years later he returned to Paris, and gained the favour of Louis XIV. by some courtier-like odes, while he also became intimate with Boileau, La Fontaine, and Molière. Racine's first period lasted from 1664, when *La Thébaïde* was played at the Palais Royal by Molière's company, to 1677. *Andromaque* was produced in 1667, *Iphigénie* in 1675, and *Phèdre* in 1677. A quarrel with Molière (little to Racine's credit) arose out of the production of *Alexandre le Grand* (1665). *Phèdre*, perhaps Racine's masterpiece, was unsuccessful at the time owing to a powerful opposition, who hired an inferior dramatist to produce a play on the same subject immediately after it was performed. During this period the poet became an Academician (1673), and made a bitter onslaught on Port Royal, which disapproved of players. From his marriage in 1677, however, he returned to the Jansenism in which he had been brought up, but was none the less a highly-successful courtier, being made with Boileau historiographer-royal, and accompanying Louis in his campaigns. His second period began in 1689 with *Esther*, and ended with *Athalie* in 1691. Racine was a perfect master of verse and of a certain thin passion, but lacked vigour; his relation to Corneille is that of Pope to Dryden.

Les Plaideurs, produced in 1668, is an excellent comedy still often acted.

Rack, an engine of torture consisting of a platform, at one end of which is a fixed bar to which a pair of limbs is fastened, at the other end a revolving bar to which the other pair of limbs is attached by cords which are rolled round the bar by a windlass and thus tightened so as to stretch the body even to dislocation of the joints. In some specimens both bars revolved; in some the bars were drawn in opposite directions.

Rackets, a modern variety of tennis played in a closed court with balls (one in use at a time) and a bat called a *racket*, the blade of which is formed of a network of cord or gut stretched on a frame of bent wood.

Radcliffe, ANN (*née* WARD), (1764–1823), author of *The Mysteries of Udolpho*, was born in London, and married at Bath William Radcliffe, afterwards editor of the *English Chronicle*. Her masterpiece appeared in 1794; it had been preceded by *A Sicilian Romance*, and was followed by *The Italian*. These and her other works dealing with ruined abbeys and castles were highly popular in their day, and mark the middle stage of the romantic movement which reached its maturity in Scott.

Radcliffe, JOHN, DR. (1650–1714), was born at Wakefield and educated at Oxford. At the end of the 17th century he was the chief physician of repute in London, and attended William III. and Queen Mary. He was very ill when Queen Anne died, and became unpopular on account of his inability to attend her in her last illness. To his munificence was due the building of the Camera, now an adjunct to the Bodleian Library at Oxford (sometimes called "The Radcliffe"), and he also left bequests to London Hospitals.

Ra-dê (ROE-DEH), a people of Cochin China, north-east of Saigon, quite distinct in physical appearance and speech from all the surrounding Mongoloid aborigines; appear to be of Khmêr (Cambodian) stock, and are remarkable for their European features; are skilled weavers, wood-carvers, and potters, and live in large communal houses like those of the Pueblo Indians of North America, but less substantially constructed. (Dr. Harmand, *Tour du Monde*, July, 1879.)

Radetzky, JOHANN, GRAF VON (1766–1858), was born in Bohemia, and entered the Austrian army in 1784. He served against the Turks and throughout the Napoleonic wars, and was chief of the staff at Leipzig. He commanded in Lombardy in 1831–36, and in the last year was made field-marshal; but his greatest glories were in his old age, when he defeated the Sardinian armies at Custoza (1848) and Novara (1849). He was then appointed Governor of Lombardy, which he had preserved for Austria.

Radiata, a term once used for one of the four principal divisions of the Invertebrates; it included those in which the parts are arranged radially from

a centre instead of being bilaterally symmetrical. It therefore comprised the Coelenterata (Corals, Jellyfish, Sea-anemones, etc.) and the Echinodermata (Sea-urchins, Starfish, Brittle-stars, etc.). The classification, however, has now been abandoned, as the Coelenterata and Echinoderms are not closely allied.

Radiation is the propagation of ethereal waves. If these waves are caused by comparatively slow vibrations, they can only be detected by electrical means. As the speed of vibration becomes quicker they become evident as heat; and when the speed has been further increased they can be perceived by the eye as light. A condenser whose discharge is oscillatory sets up ethereal vibrations which are essentially the same as heat or light vibrations. A condenser of large capacity may start waves a thousand miles long, but on discharging a Leyden jar of minute dimensions waves only a few feet in length would result; and if we were able to obtain a circuit so small that its dimensions were comparable with those of an atom, then without doubt waves 25-millionths of an inch long would be produced and be able to affect our eyes; they would in fact be light-waves. Electric disturbances and light both travel at the same speed in space, the velocity being 300,000 kilometres per second. In matter this equality of speed is not always obtained, for the speed of waves of different wave-lengths is retarded differently. We know that the shorter waves of light, *i.e.* those at the blue end of the spectrum (*q.v.*), are retarded more than longer ones at the red end, although the latter are only about twice as long as the former, so that we should expect some difference when we are dealing with waves many millions of times greater. It has been calculated that if a Leyden jar could be obtained to discharge an atomic charge, the wave-length of the oscillations would be that corresponding to the invisible rays at the violet end of the spectrum; and it may be due to this connection that the ultra-violet rays have so great a chemical action. Molecules are often considered to consist of electrically-charged atoms; when heated they vibrate mechanically, and thus also excite an electric radiation. Many of their different rates of vibration give rise to light, and the science of spectroscopy deals with the measurement of these different rates. Imagine a system of waves meeting a substance whose insulation is perfect; some of the radiation will be reflected and some transmitted, but none will be lost. If, however, it meet a conductor, no radiation will be transmitted; it will all be either reflected or lost. A conductor of electricity will therefore be opaque to light; this is exemplified by the fact that metals—which are good conductors—are opaque even when extremely thin. On the other hand, a transparent body must be an insulator. A perfect conductor would totally reflect radiations of every wave-length, and no dissipation would occur. In an ordinary conductor some of the radiation is destroyed; the vibrations of the ether are converted into vibrations of the atoms, and heat is produced. Radiation can be affected by matter in different ways; it can be reflected or

refracted, undergo diffraction, dispersion, or absorption, or be polarised. We are accustomed to the idea that light and heat are not different in essence; but the conception that electrical disturbances are also the same in kind is not quite so general, and it was left for Maxwell to show that light is produced by electrical vibration.

Radical Theory. The researches of Gay Lussac on cyanogen compounds showed that in many compounds the group CN entered into reactions as if it were a single elementary atom, and other researches proved that many similar groups existed which remained unaltered during many transformations of the substances in which they existed. In this way chemists endeavoured to explain the composition of organic compounds by supposing them built up of such atomic groups or *radicals*. The views upon the nature and characters of the radicals and their compounds formed the subject of much controversy during the latter part of the first half of the present century, Berzelius and Liebig taking most prominent parts. Although many errors crept into their views, the influence of the older radical theory in the generalising and co-ordinating of chemical ideas was exceedingly great, and laid the foundation for other more advanced views afterwards promulgated.

Radicle (pronounced with the accent on the second syllable) is the primary root in its embryonic stage. It occurs temporarily in ferns, horse-tails, and palms; but in most gymnosperms and dicotyledons develops into a tap-root of a permanent character.

Radiolaria, a class of Protozoa (q.v.) belonging to the Rhizopoda, and including some of the most specialised of the Protozoa. They nearly all have a skeleton, which is formed usually of silica, but in one group (the Acantharia) it consists of a substance allied to chitin and called "Acanthine." The structure may be simple, consisting only of spicules, as in the *Beloides*, which may be fused at one end, or be embedded in some organic matrix; as a rule the skeleton is complex, being composed of a series of rings, spines, or variously-shaped arrangements of lattice-work. The body is divided into two parts, a central capsule and an extra-capsular region. These are usually separated by a membrane pierced by numerous fine pores (Porulosa), or one or more apertures (Osculosa). The extra-capsular region is supported by a gelatinous skeleton known as the calymna in addition to the siliceous or acanthin skeleton which it usually surrounds. Reproduction is effected by budding, fission, or the development of spores; the first is rare and the last is the normal method. There are two kinds of spores: isospores and anisospores, of which the latter are sexual and the former asexual; an "alternation of generations" (q.v.) therefore takes place. The Radiolaria are all marine, and are commonest in tropical seas far from land, living either on the surface or at great depths. They occur less sparingly even in Arctic seas. They are known from very early geological ages; rich faunas are known

in the Lower Silurian (Ordovician) rocks, and it has been recently claimed that they occur in Pre-Cambrian rocks; in that case they would be the oldest form of life. They are small in size, the simple ones being rarely more than $\frac{1}{25}$ inch in diameter; a few, however, are an inch in diameter, while some compound ones (*Collozoum*) may be a foot in length. Nevertheless, they are of great geological importance, as they form thick deposits as in the Barbados (late Tertiary in age), in Jurassic, and Palæozoic cherts, and in some "phtanites" in the schists of the Cottian Alps. Their occurrence in some crystals of felspar (albite) has also been proved. The classification is as follows:—

- I. PORULOSA: Capsular membrane penetrated by numerous fine pores.
 1. *Spumellaria*: Pores evenly divided: skeleton of silica or absent.
 2. *Acantharia*: Pores in lines or groups: skeleton of acanthin.
- II. OSCULOSA: Capsular membrane with one or more large pores.
 3. *Nassellaria*: a porous aperture at one end of the axis.
 4. *Phæodaria*: the main aperture is surrounded by a phæodium—a mass of rounded green bodies which may be algae living with the radiolarian.

Radiometer is usually a glass vessel containing highly-rarified air. Light vanes are carefully balanced on an axis about which they are free to rotate. If two equal discs are balanced on an arm, and a light be allowed to shine on them, nothing will happen; but if alternate sides be coated with lampblack, rotation will commence in a direction such that the blackened side moves backwards as soon as a candle or other light is brought near. This is due to the fact that the blackened face gets hotter than the mean temperature, and the difference of pressure on the two sides causes motion. Crookes found that a rotation could also be obtained by using unblackened vanes if the shape were altered. He therefore balanced four vanes on two arms, and bent them at the ends; heat then fell upon the convex side of one vane and the concave side of another and rotation occurred. If, further, the vanes be plane and of the same appearance, but of different materials, *e.g.* one of chromic oxide and one of copper tungstate, rotation will occur. It has also been shown that the effect varies with the light used. The cause of the motion has been discussed by Osborne Reynolds and by Clerk Maxwell.

Radiophony. When a beam of light falls on a body, such as lampblack, capable of absorbing heat, the body expands. If a succession of flashes occurs, the lampblack will alternately expand and contract, *i.e.* it will vibrate, and this vibration is capable of emitting sound. If the lampblack be contained in a tube connected with a sounding-board whose frequency of vibration is the same as that of the flashes, the sound will be audible to some distance. Professor Graham Bell has shown that practically all substances are capable of thus converting radiant into aconstical energy.

Radish (*Raphanus sativus*), possibly a cultivated race of the wild radish (*R. Raphanistrum*),

from which it differs in its enlarged tap-root and non-articulated seed-pod; it is a hardy annual, cultivated from early times from Japan to Europe for its edible roots. It belongs to the order Cruciferae (q.v.), and has the pungent antiscorbutic properties of the order. The root is fusiform or napiform, and red, white, or brown. The flowers vary from white to pale violet with darker veinings, and the pods are smooth and pointed. When young, these are used instead of capers; and the roots, when large, can be eaten boiled; but their main use is as a raw salad.

Radius is any line drawn from the centre to the circumference of a circle. [CIRCLE.]

Radius of Gyration of a body with respect to an axis is the distance from the axis at which the whole mass of the body should be placed in order that its moment of inertia about that axis should remain the same.

Radius Vector is a line drawn from a centre of force to a body describing an orbit round that centre, and is a term of special application in astronomy, where it usually denotes the line drawn from the sun to the position of a planet at any time. It is obvious that this line is continually changing its length and direction.

Radnor, the name of an inland county of South Wales, having an area of 432 square miles, and being bounded N. by Montgomery, S. by Brecknock, W. by Cardigan, and E. by Hereford and Shropshire. The chief river is the Wye, noted for its picturesque scenery; the Teme, the Lugg, and the Ithon, are smaller streams. Though the district possesses mineral resources, they are not considered worth the expense of working. Presteign is the present capital, having taken the place of New Radnor, a decayed borough, which is now grouped with other villages to send one member to Parliament, the county also returning one.

Raeburn, SIR HENRY (1756-1823), portrait-painter, was the son of a Scotch mill-owner. While an apprentice to an Edinburgh goldsmith he attracted the attention of Deuchar, and soon began to execute water-colour miniatures. Having married a rich lady, he began to paint portraits in oil; and in 1785 was able to go for two years to Italy, armed with introductions from Reynolds. He painted the portraits of Scott, Jeffrey, Dugald Stewart, and all the great Scotsmen of his day. In 1812 he was elected President of the Edinburgh Society of Artists, and in 1815 R.A.

Raff, JOACHIM (1822-82), a composer of the Wagner school, was at first a schoolmaster, but rose to be director of the Frankfort Conservatoire of Music. A *protégé* of Mendelssohn and a friend of Liszt, he was a prolific composer of symphonies, overtures, and concertos, his music for the violin being in especial repute.

Raffia. [RAPHIA.]

Raffles, SIR THOMAS STAMFORD (1781-1826), English administrator and naturalist, was in early life a clerk at the East India House, whence he

was promoted to an important official post in Prince of Wales' Island. He made a close study of the Hindu and Malay peoples. In 1811 at his suggestion Java was annexed, and he became governor. He was recalled in 1816, and in 1817 published his *History of Java*. He was knighted and sent to Sumatra in a gubernatorial capacity, and aided in the abolition of slavery. He established Singapore as a British shipping station, and collected a vast quantity of natural history specimens. He helped to found, and was first President of, the Royal Zoological Society.

Rafflesia, an extraordinary genus of parasitic plants, natives of Java and Sumatra, the type of a small isolated order of dicotyledons, taking their name from Sir Stamford Raffles, by whose party it was discovered in 1818. It grows on the trailing stems of a vine belonging to the genus *Cissus*, and has no foliage-leaves or true stem, but consists of one huge flower and a few bracts. The bud is like a cabbage and, when open, the flower reaches two or three feet across, with a five-cleft, fleshy, carrion-like perianth which has a ring-shaped corona. The flowers are diœcious, the anthers opening by a pore, and the inferior ovary being one-chambered with numerous ovules. The perianth becomes fly-blown and putrefies.

Ragged Robin, the appropriate popular name for the spring-flowering *Lychnis Flos-cuculi*, owing to the remarkably torn (*laciniate*) condition of its pink petals. It belongs to the order Caryophyllaceæ, and is common in marshy spots. A white-flowered form also occurs.

Raglan, BARON (FITZROY JAMES HENRY SOMERSET), was the son of the Duke of Beaufort, and was born in 1788. At the age of 16 he entered the army and fought in the Peninsula and at Waterloo, where he lost his right arm. In 1815 he performed various diplomatic duties at Paris, and for the next few years held other important posts. When the Crimean War commenced he was appointed commander-in-chief of the English forces, and was present at all the leading victories. The soldiers suffered terribly, however, through mismanagement of the commissariat, and Lord Raglan, who was now field-marshal, received some of the blame. Mr. Kinglake and others, however, championed his cause, but the blame seems to have hastened his death, which occurred in 1855.

Ragusa (Slav. *Dubrovnik*), a fortified port in Dalmatia, on the E. coast of the Adriatic, at the foot of Monte Sergio. From the 3rd century until 1808 it was the centre of a small republic, but was incorporated with the Austro-Hungarian Empire by the Treaty of Vienna. The harbour, protected by stone forts, is small and shallow. Most of the trade has now gone to Gravosa. Oil is the staple export, the production of wine having been marred by phylloxera.

Ragwort (*Senecio Jacobæa*), a very handsome British member of the order Compositæ (q.v.), a common weed belonging to the same genus as the rayless groundsel (q.v.) and closely related to the

garden Cineraria (q.v.). It derives its name from its much-divided, rather fleshy leaves. It grows three or four feet high, with a corymbose inflorescence, a foot or more across, of numerous radiate gold-yellow capitula, and, as it occurs socially on waste ground, it is very effective.

Rahel, IBN, an Arabian chronicler, was born in Egypt, and was a Christian. He wrote a chronicle in Arabic of events from the earliest times to 1239 A.D. This work was translated into Latin by Abraham Echellensis, and is of extreme rarity. A copy is preserved in the Vatican.

Raikes, ROBERT (1735-1811), founder of Sunday-schools, was a printer and newspaper proprietor of Gloucester, and used his fortune, chiefly acquired from the sale of patent medicines, in furthering benevolent objects. In 1780 he instituted the system known as Sunday-schools.

Rail, any bird of the genus *Rallus*, type of a family (*Rallidae*). The Common or Water-Rail (*R. aquaticus*) is fairly common in Britain, though it often escapes notice from its shy habits. It frequents marshy ground, and its favourite hiding-place is among the thick vegetation near water. The adult male is a little less than a foot long; general plumage, brown streaked with black, slaty-grey on sides of face and under-parts. [CORN-CRAKE.]

Railways. At the present time railways form in most countries of the world the chief means of internal communication. Their influence in stimulating industry and in creating new branches of trade since their introduction into England in the year 1825, and into other countries at slightly later periods, has been simply incalculable. The subject is such a wide one that it can be most conveniently dealt with under the following heads:—

- (a) *History*.
- (b) *Railroad Location and Permanent Way*.
- (c) *Signals*.
- (d) *Stations*.
- (e) *Locomotives, Carriages, and Waggon*s.
- (f) *Statistics of Traffic, Mileage, and Rolling Stock*.

(a) *History*. In his fine work, *Das Eisenbahn-Geleise*, Haarman traces the history of permanent way back to the times of Strabo, Diodorus Siculus, and Herodotus. The history of the railway, however, is not the history of permanent way so much as the history of the locomotive. It was the motive-power in the form of the locomotive that first made railways possible, and for the first locomotives we must look back to the times of Cugnot (1769), Trevithick (1802), and Hedley (1815). But no advance was made in this means of internal communication until the opening of the Stockton and Darlington Railway in 1825, and the famous Rainhill trials, in which the *Rocket* came out victor and established the fame of George Stephenson. Even then considerable opposition from vested interests delayed the spread of railways, and it was not until after 1840, and during the speculative time of the Railway Mania, that lines were built rapidly. Since then progress has been steady and sure, and there is but little of importance to record.

Other countries have had similar experiences, but in America, during the last thirty years railway construction has been surprisingly rapid. The history of railways in the future will probably not be much concerned with construction, as most civilised countries are now covered with complex networks of lines, but will deal with struggles between these wealthy corporations and the State, labour, and trade interests. We may ultimately, as in Germany to-day, see State purchase.

(b) *Railroad Location and Permanent Way*. It is necessary, before laying down the permanent way of a railway, that careful comparison of all the likely routes between the points to be connected by the line should be made. Definite rules have here only a limited application, as the circumstances vary so greatly in each case. It is wise, however, to avoid heavy grades and curves of small radius as far as possible. Heavy grades always limit the load that can be taken by the locomotive, and, if very severe, require double engine-power, this resulting in largely increased expenditure. In level countries, where there is a choice of routes, it is, as a rule, unwise to neglect any points of importance lying at short distances from a direct line drawn between the towns to be connected. By judicious deviations these points can always be served by the main line without greatly increasing its length between its extreme points; the result is, as a rule, large extra traffic.

Having decided upon the route the line is to take, the earthworks and cuttings are formed and the bridges erected. The former are sloped according to the nature of the soil, and the latter are so constructed as to bear the heaviest loads that will travel over them. Tunnels, viaducts, and other large works receive special treatment, according to the conditions governing their establishment. Finally a bed of specially-prepared ballast is laid down, on which what is known as the permanent way is placed. Permanent way consists of sleepers, chairs, keys, fishplates, and rails. The sleepers are in most cases of wood (which is creosoted or otherwise treated to prevent decay), but of late steel sleepers have been rather largely used. In nearly all cases sleepers are placed crosswise, though on the Great Western Railway there are many miles of longitudinal sleeper road. This latter gives easier running but renders repairs to the road very difficult. Chairs, keys, and fishplates are fastenings used to connect the rails with the sleepers, or with one another. Rails are now generally made of steel, in sections about 30 feet long, weighing from 75 to 100 lbs. to the yard. In England the bull-headed type is used, but on the Continent and in America the broad-base Vignoles pattern, which dispenses with chairs and keys and is simply bolted or spiked to the sleeper, has found favour.

(c) *Signals*. In the early days of railways the methods adopted to warn the driver of danger on the line ahead were exceedingly primitive. As time went on and traffic increased, it was found necessary to devise some more certain means of protecting trains. This resulted in the adoption of the Time System, under which trains were not

allowed to follow one another on the same metals until after a certain interval, generally five to ten minutes, had elapsed. Although working well on lines with a small traffic, it was soon found that a space interval was more efficient to prevent accidents than the time interval. This method, at present employed in the United Kingdom almost solely, and on the Continent of Europe and in the United States to a partial extent, is known as the Block System. A line worked on this plan is divided into sections of various lengths, each furnished with a signal cabin. The signalman, being advised of the approach of a train, asks, by means of special instruments, the man in the box ahead if the line is clear. On receiving an affirmative reply, he is enabled to lower his signals. It will thus be seen that two trains can never occupy one section at the same time, and herein lies the great merit of the Block System.

It is not sufficient, however, to protect trains in this manner, but it is also necessary to ensure that points at junctions should be set for the particular line about to be travelled over before the signal for that line is lowered, and that, when once a line is *made* for a train, all other signals giving access to points fouling this line should be locked at danger. This is effected by interlocking the levers working such points and signals by means of ingenious appliances known as locking frames, located in the signal-boxes. As in the case of the Block System, this country considerably leads all others in the interlocking of its points and signals.

In the limited space at our disposal it is impossible even to mention the numerous clever mechanical devices that are in use on railway lines to provide for special cases and to meet emergencies. It will only be necessary to point out that the signal-posts should, as a rule, be high and have a clear sky background, so as to enable them to be plainly seen by the drivers of oncoming trains. Experience shows that semaphore arms are more easily distinguished than circular discs, and that the most convenient colours for signal-lights are red for danger and green for clear.

(d) *Stations.* Railway-stations are built at intervals along the line to serve the requirements of the neighbouring population. They may briefly be divided into passenger and goods stations. The smaller type of passenger station is generally furnished with ticket-office, waiting- and retiring-rooms concentrated together on one side of the line, and a small shelter on the other platform. The goods service is most conveniently performed when the loading and discharging shed is close to the main passenger buildings, and so under the surveillance of the station-master. Stations of a larger type, such as those for junctions and small towns, have in many cases waiting-rooms for each class, refreshment-rooms, and other conveniences. Overbridges on railways should be provided to enable passengers to cross from one platform to another. The goods station is frequently quite independent of the passenger in towns of moderate importance. It should be furnished with loading and discharging platforms, cranes, weighbridges,

and storeroom. It should always, if possible, be built on the same side of the line as the large manufactories, etc.

Stations of the largest sort have, of course, more complete installations still, and the goods service is quite distinct. Examples of the largest passenger stations in this country are those at Birmingham, Carlisle, York, Perth, St. Pancras, Liverpool Street, etc., and abroad, at Paris, Frankfort, Cologne, Milan, etc.; and in America at Philadelphia and Jersey City. In England it is always customary to provide a raised platform, nearly three feet high, but on the Continent, where passengers are confined to the waiting-rooms until a few minutes before the train starts, the platforms are rarely higher than six inches.

At the largest centres depôts for housing, coaling, watering, and repairing of locomotives, etc., are established. They should adjoin the passenger and goods stations, but be kept quite distinct from them. Water-tanks, coal-shoots, ash-pits, and turntables are also necessary. Difference of opinion seems to exist as to whether a rectangular or circular building is more economical. Some of the largest locomotive depôts in this country are those at Crewe, Derby, and Swindon, and in America, at Altoona.

(e) *Locomotives, Carriages, and Waggon.* Since the days of George Stephenson's famous *Rocket* the locomotive has, of all the factors going to form a railway, undergone perhaps the least change. It consists now, as then, of a fire-box in which combustion takes place; of a boiler filled with water surrounding tubes through which the heated gases given off by combustion in the fire-box, flow, heating the water on their way and converting it into steam; of a pair of cylinders (or in compound engines three or perhaps four cylinders), to which the steam is conducted from the boiler by suitable pipes; of a piston-head, moving steam-tight in this cylinder, and attached to a piston-rod, which, connected by cranks to the axle of the driving-wheels, revolves these latter; and of eccentrics, which are so fixed to the axle and connected with the valve-motion that steam is admitted as desired to the cylinders. These are the main features of almost all locomotives; minor details, of course, vary in particular cases, but not to any great extent. There are, for instance, bar frames and plate-frames, Wootton and Belpaire fireboxes, etc.

But although there is great similarity in the main points of locomotive construction, there is considerable variation in size and weight. In the old days single-driver locomotives were largely used; but, as trains grew heavier and faster, it was found that adhesion was insufficient, and accordingly the load on the driving wheel was increased until it was as heavy as the permanent way would bear. Then, in order to distribute weight, four-coupled engines were introduced, and these are now, with driving wheels about $6\frac{1}{2}$ to 7 feet in diameter, used almost solely for passenger train working. For goods traffic six-coupled locomotives with wheels about five feet give the best results, and for heavy trains on severe grades eight and even ten coupled types are employed. Suburban traffic is generally

worked by tank engines, which carry their water at the side of the boiler and their coal in a small bunker behind, and thus dispense with a tender. Main-line locomotives of recent years weigh in most cases more than 70 tons, including tender.

Carriages and waggons form a considerable part of the rolling stock of a railway. The former are constructed on the compartment system in this country and on the Continent generally; but in America, where there is virtually only one class, against three here, the vehicles are open throughout. Each method has its advantages, the balance being probably rather in favour of the American style. In the United States and our own country passenger carriages are much more comfortably upholstered than on the continent of Europe, internal dimensions are also larger, and there is more window space and greater cleanliness in the carriages of the

in six of the leading countries of the world. The figures are brought up to as late a date as possible:—

Country.	Length in Miles.	Loco- motives.	Carriages.	Waggons.	Gross Receipts.
					£.
Austria-Hungary	16,592	4,684	9,277	105,403	24,988,143
France - - - -	22,715	9,747	22,637	249,241	42,859,120
Germany - - -	26,245	12,811	23,703	255,972	54,481,079
Great Britain and Ireland - - -	20,055	15,552	35,021	499,904	70,943,376
Russia - - - -	18,850	6,591	7,560	129,753	40,450,116
United States -	162,305	27,850	20,582	963,223	197,400,000

Rain, the moisture of the air condensed into drops too large to float in the air as cloud or mist.



S FT. SINGLE-DRIVER EXPRESS, GREAT NORTHERN RAILWAY.
(From a Photograph by J. R. Thompson, Doncaster.)

lowest (or third) class. Some attention, however, remains to be paid to heating and lighting.

Besides the ordinary passenger rolling stock, special vehicles for dining, sleeping, etc., are provided at somewhat higher charges. These vehicles are generally mounted on bogie trucks, and are decorated and upholstered (especially in America) at considerable cost. In England dining cars for third-class passengers have lately been tried with some success, the only objection being that the dead weight of these carriages (over 30 tons) compares unfavourably with ordinary vehicles of similar capacity (12 to 14 tons).

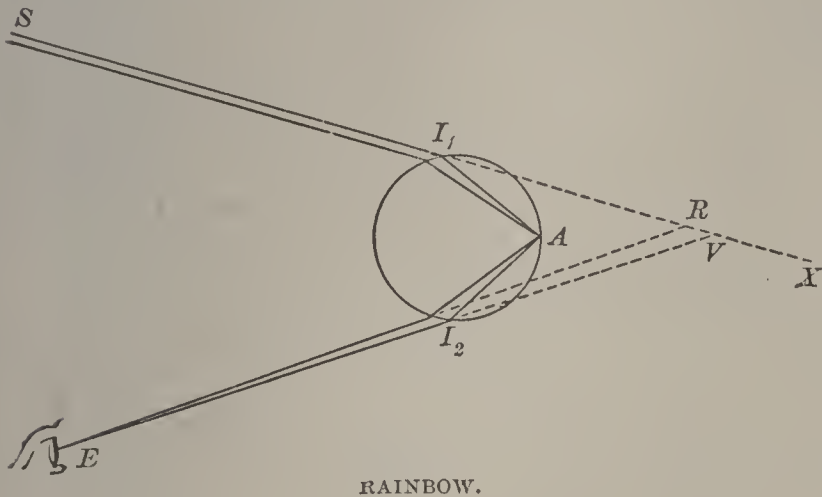
Railway waggons should be constructed as strongly as possible, in order to resist shocks in shunting operations. They may be divided into covered waggons and open waggons, the former being generally used for valuable goods, meat, etc. Besides the ordinary types used for conveying merchandise and minerals, special vehicles have been constructed for the conveyance of fish, frozen meat, oils, tar, heavy guns, etc., which need not be described in detail here.

(f) *Statistics of Traffic, Mileage, and Rolling Stock.* The following table gives some idea of the importance of railway interests and railway traffic

It generally originates in clouds, the upper part of which, being more free from dust motes than the lower, forms larger drops. Whatever tends to lower the temperature of the air below the dew-point is a cause of rain. Thus when the wind blows over a wide ocean, the rainfall is large; when the wind blows from warmer into colder regions, the rainfall is large; and when the wind blows over a mountain range, the rainfall is high on the windward, and low on the leeward side of the range.

Rainbow is caused by the refraction which rays of light undergo when the sun is shining on drops of water. These drops of water may be in the form of rain, or may be artificially produced, as in spray from a fountain. Imagine a beam of light falling upon a spherical rain-drop, and after refraction and reflection entering an observer's eye. It is apparent that for some position of the drop with regard to the sun and the observer the ray will, after reflection, from the inside surface of the drop, have a path symmetrical with the one before such reflection. Let $S I_1$, be such a beam from the sun incident on the drop at I_1 , it will be refracted in the direction of $I_1 A$, reflected at A in the direction $A I_2$, and at I_2 , suffer a second refraction in the direction

I_2E . In this case the ray has undergone the minimum deviation, and it is by means of such rays that the observer sees the bow. The different elementary colours are, however, refracted differently; the violet rays will deviate most from their incident direction, and the red least; EV and ER may represent the directions in which the observer sees these colours in the sky. If SI_1 be produced to cut ER and EV , the deviation XVE of the violet rays is



greater than the deviation XRE of the red when X is any point beyond V on SI_1 produced. Hence the observer would see in the sky a narrow strip of colour due to this one drop, and the red colour will be above the violet. A number of drops will give rise to a number of such strips which unite to form the coloured bow. Sometimes a secondary bow is seen outside the primary, and in this case the violet is above the red; this is formed by the rays which undergo two reflections inside the drop. It is seldom that more than two rainbows are seen at a time, since the luminosity decreases with each successive reflection; the primary is always by far the most brilliant.

Rainfall, the amount of rain that falls at a particular spot or over a certain area in a given time. It is generally stated in inches, being collected in a rain-gauge (q.v.), and allowance being made for evaporation. It is usual to take an average of the total falls each year for a term of years, but a more accurate conception of atmospheric moisture will be obtained if this average is supplemented by a record of the average number of rainy days or by monthly averages. Most of England has an annual rainfall of less than 40 inches, Huntingdonshire having only about 21 inches. Most of Ireland has more than 40 inches; but no part more than 76 inches; whilst in Scotland the highest average is 128, and at Seathwaite, in the English Lake district, the average is 146 inches. The highest recorded annual average in the world is 493 inches at Chirrapunji, on the Khasi Hills, in Lower Bengal. On five successive days 30 inches each day has been recorded at this station, whilst 7 inches is the highest on record for one day in Great Britain.

Rain-Gauge, an instrument for measuring rainfall, consisting generally of a circular funnel, of known diameter, which leads to a receiver. If the

diameter be 4.697 inches, each fluid ounce of rain collected represents one-tenth of an inch, since the area will be 17.33 square inches and a fluid ounce at ordinary temperature is 1.733 cubic inches. Glaisher's gauge, recommended by the Royal Meteorological Society, is a copper cylinder 8 inches across and 18 inches high, with the funnel about half-way down, so as to allow for snow. The mouth of the funnel should be one foot from the surface of the ground, as, from wind and other causes, the amount registered varies at different heights.

Raised Beaches are ledges on cliffs or near the sea, but at some height above its present level, covered with shingle and sand, often with sea-shells, and sometimes with sea-caves behind them. Their raised position is generally taken as evidence of the land having risen since their formation. On the coast of Chili this has been brought about at various successive periods by violent earthquake action; but elsewhere, as on the coast of Scotland and Norway, the movement seems to have been more gradual. Some geologists, however, explain such raised sea-beaches on the assumption that the land has remained rigid while the ice of the Glacial Period raised the sea-level by attraction. Raised beaches left by the shrinkage of evaporation surround the Great Salt Lake and the Dead Sea. [PARALLEL ROADS.]

Raisins, dried grapes, generally sun-dried, mentioned in early books of the Bible, and now largely imported into England. Some are dipped in potash-lye or in olive-oil to give them a gloss. The seedless varieties are known as *sultanas*. Most of our raisins come from Malaga, Valencia, and Alicante, the finest being known as *Malaga clusters*, which, as well as *Malaga layers*, are a muscatel grape. Smyrna raisins, of which the best are *Elemé*, are less imported; but all sultanas come from this district. The total value of raisins imported is nearly a million sterling per annum.

Rajah (Hindustani *rāja*, from Sanskrit *rājā* [*rāja*—*rājan*], "a king," "a prince," "a chief"), the title of Hindu sovereigns, some of whom are distinguished by the title *mahārāja(h)*, "great king."

Raj-Bhansi (i.e. "sons of kings"), the title assumed by numerous Hinduised aborigines of Kutch-Bihar, Bengal, who claim to be Aryans of the Kshatriya (warrior) caste, but who are really a branch of the Koch race (q.v.) dominant in the Lower Ganges basin before the arrival of the Aryans; the genealogies of the local "rajas" showing Aryan descent are all fabrications. The Maharaja, paramount lord of all the Raj-Bhansi, has married the daughter of Kishab Chandra Sên, founder of the Brahmo-Somâj deistic sect. In Assam there is an agricultural caste specially known as Raj-Bhansi, who are also of Koch descent, and who number about 110,000.

Raj-Gond, a main branch of the Dravidian Gonds, of the Central Provinces, India, who claim royal descent (whence their title of "Royal

Gonds”), and consider themselves to be akin to the Rajputs. They are numerous, especially in the province of Nagpore, where they form two main divisions: *Raj-Gond* proper and *Ravanbhansi* with twenty-seven subdivisions.

Raj-Mahâli, Dravidian people of the Rajmahâl Hills, north of Chota Nagpore, between Upper and Lower Bengal; call themselves *Mali* (“Men”), and speak an uncultivated but distinct Dravidian dialect of archaic type. (Dr. Caldwell, *The Languages of India*, p. 10.)

Rajputana, the name given to a group of twenty-one states in Central India, all of which are under independent native rule except Ajmere, whence a British resident exercises supervision and advisory powers. The total area thus administered amounts to some 130,000 square miles, having the Punjab to the N., Bombay to the S., Sind to the W., and the North-West Provinces to the E. It is traversed by the Aravalli range, N. of which lie sandy deserts, whilst the smaller portion to the S.E. contains many fertile valleys and uplands. The Loni, Chambal, and Banas are the chief rivers, and the only natural lake of importance is the salt lake of Sambhar. Cereals, cotton, pulse, hemp, and flax are the chief products, but camels, horses, and sheep are bred in considerable numbers. There are few industries save metal-work, ivory-carving, and salt-drying. Cobalt, copper, iron, alum, and zinc are worked in parts, and the supply of building stone is plentiful. Banking and money-lending flourish especially among the Marwaris.

Rajputs (“sons of kings”), one of the great divisions of the Indian Aryans, who give their name to the region of Rajputana, in North-West India, where they have been settled from remote times, but, as would seem, subsequently to the first Aryan invasions. Although claiming to be high-caste, *i.e.* full-blood Hindus of the Kshatriya (warrior) class, the claim is disallowed by the Brahmins, and there can be no doubt that they had already contracted alliances with the Jats, Bhils, and other aborigines before the institution of caste. The purity of the race, however, appears to have been preserved in many of the noble families, and especially in that of the Udaipur dynasty, whose headship is recognised by all the Rajputs. The regular features and light complexion, especially of the women of high birth, show that the original stock was undoubtedly Caucasian, and most probably of Aryan speech. But it is equally certain that the Rajputs were preceded in their present domain by other Caucasians and Aryans, and especially by the Jats, with whom they contracted alliances in prehistoric times. In North-West India the pure and mixed Rajputs are divided into endless tribal groups or classes (Sherring gives an incomplete list of six hundred), with a population of over 12,000,000 in Rajputana alone, and many more in Punjab and the North-West Provinces. They are distinguished by their warlike character and highly chivalrous sentiment towards the women, despite the former

universal prevalence of female infanticide and suttee. With few exceptions the Rajputs are Hindus by religion, and those of Rajputana speak a pure Hindi dialect developed in the 12th century specially under the influence of the great poem Chand Bardai. (Sherring, *Hindu Tribes and Castes*, vol. ii.)

Rakhaingtha, the aborigines of Arakan, to which province of Burma they give their name (*Arakan* is a corrupt form of *Rakhaing*); are a primitive branch of the Burmese family, hence in their chronicles are called M’rammakrih, *i.e.* “great” or “elder Burmese;” speech a rude and archaic form of Burmese, written with a modified form of the Burmese alphabet; religion Buddhism, except amongst the Mrus, Shendus, and some other hill tribes, who are still Nature-worshippers.

Raleigh, SIR WALTER (1552–1618), discoverer and historian, was born in Devonshire of an ancient but reduced family. In his 17th year he became one of the volunteer troop which was then sent into France, and served there for about five years, afterwards going to the Netherlands, where he also won distinction as a soldier. In 1579 he accompanied his half-brother, Humphry Gilbert, in a colonising expedition to North America, but returned very soon, as the project was not successful. We next find him in Ireland, where his bravery and success in crushing the rebellions of the south procured him the appointment of Governor of Cork and to the supreme command in Munster. Here he met Spenser, the poet, who had written some of his *Fairy Queen*, which Raleigh admired so much that he induced its author to go to London and publish it, which was accordingly done. In Munster, Raleigh acted with severity, but was not peculiar in that respect. About 1583 he returned to England, where he was received at court, the queen being charmed by his gallant bearing and fascinating manners. He speedily became a favourite, and was permitted to make a second expedition to North America with his half-brother, and in this journey made many discoveries, besides founding a colony in that portion of the country named by him Virginia, in honour of Elizabeth. On his return he brought with him the potato and tobacco plant, by which he is probably best known to the world. He received knighthood from the queen, some large sums of money, and various tracts of land in Ireland. In 1584 he was elected a member of Parliament, representing Dorset. When the Armada threatened England Raleigh took a prominent part in the victories obtained over the Spaniards. Appointed a gentleman of the privy chamber, he soon after fell into disgrace, through his attachment to the daughter of Sir Nicholas Throckmorton. He was imprisoned for a time, but married the lady of his choice, who was one of the queen’s maids of honour. His next notable exploit was the help he rendered in the discovery of Guiana, and he also inflicted several further defeats on the Spaniards. His history of the discovery of Guiana is excellent, and was much esteemed by his contemporaries for its style. Besides his reputation as a courtier and soldier, he had slowly

acquired fame as a writer. In 1596 he was one of those instrumental in the capture of Cadiz, and soon after was re-established in the queen's favour. He was made ambassador to Flanders in 1600, and was offered the viceroyalty of Ireland, which he refused. His enemies induced James I. to believe that he was conspiring to remove him from the throne, and he was imprisoned in the Tower for more than twelve years, during which he wrote his admirable *History of the World*. He was released in 1616, but did not receive a pardon, and as he again attacked the Spaniards, then at peace with England, he was tried for the offence and condemned to death. He met his fate calmly, being beheaded on October 29th, 1618. Ben Jonson, perhaps not unjustly, described him as esteeming glory more than conscience.

Ramadân, the great Mohammedan fast, which occupies their ninth month (also called Ramadân) before the lesser Bairam (q.v.).

Rāmāyana (Sanskrit)—the expedition of Rāmā, i.e. Rāmachandra, Vishnu's seventh avatar—the title of Vālmiki's great epic poem in Sanskrit, containing 24,000 verses in seven books or *Kāndas*. The main theme is the expedition of Rāma through the Deccan to Ceylon to recover his wife Sītā.

Rambouillet, MARQUISE DE (CATHERINE DE VIVONNE), was born in Rome in 1588, her father being French ambassador there, and her mother a member of one of its aristocratic families. She was married at the age of 12 years, and went to France, where the society of the court was not at all to her taste. She initiated the idea of forming a society of her own, and, being a lover of the arts and of literature, rich and hospitable, she soon gathered into her *salons* all that was best and most intellectual in Paris. French literature of that time is full of references to her and her circle, which, however, finally succumbed to its affectations, being dissolved at her death in 1665. The most notable men in France were members of her *coterie*.

Rameau, JEAN PHILIPPE (1683–1764), French composer, produced his first piece at Avignon, where he afterwards became organist. He published in 1722 his *Treatise on Harmony*, and in 1750 his great work, *Demonstration of the Principle of Harmony*, appeared, and made him famous. He was called to Paris, and while there composed numerous works for the theatre; some of them being of great excellence.

Rameses II., King of Egypt, whose name is recorded on many monuments as that of a great conqueror, though he was the builder of them, lived 1,400 years before our era, and reigned 66 years. He was a pitiless king, and the Egyptians left his tomb unfinished in token, it is said, of their resentment.

Rammohun (1780–1833), an Indian philosopher, who was discarded by his family for his attack upon some of the tenets of the Brahmin religion. He studied the religions of other nations, learnt English, and became a warm adherent of

British power. He translated the Vedas into English, and, though not a Christian, adopted what he believed the best part of that and other religions. He strongly denounced the horrible Hindu practice of the sacrifice of widows, and incurred the resentment of the Hindu populace. In 1830 he was sent to England by the King of Delhi as an ambassador, and died at Bristol in 1833.

Rampion, or RAMP (a corruption of the Latin *rapunculus*, a diminutive of *rapa*, "a turnip"), is the old English name for a species of Campanula (*C. Rapunculus*), which, with allied forms, is still cultivated in France and Italy for the sake of its roots. The name is also applied to the genus *Phyteuma*, allied to the Campanulas. It is rare in Britain, but extremely common in the Alps.

Ramsay, SIR ANDREW CROMBIE (1814–91), geologist, was born at Glasgow, and after leaving its university received an appointment on the Geological Survey of the United Kingdom. He finally became director of it, besides holding other important positions. He was made professor of geology at University College in 1848, and at the Royal School of Mines in 1851. In 1881 he was knighted on retiring from his public appointments. He published many valuable scientific works, chief among them being his popular *Physical Geology and Geography of Great Britain* (1853), which is much used by students.

Ramsay, VERY REV. EDWARD (1793–1872), Dean of Edinburgh, was born at Aberdeen, and graduated at Cambridge. He became a popular preacher, was made Dean in 1831, and in 1835 refused a bishopric. He is best known by his extremely popular *Reminiscences of Scottish Life and Character*, which has run through a great many editions.

Ramsden, JOHN (1735–1800), a distinguished mathematical instrument maker, was born in Yorkshire. He was at first a humble workman, but turned his attention to the making of optical and other instruments, and married the daughter of Dollond, the famous optician, and carried on a similar business. He improved many instruments and invented others, and was made a F.R.S. He received the Copley Medal in 1795.

Ramsgate, a port and seaside resort in the Isle of Thanet and county of Kent, 79 miles S.E. of London. It has two fine piers enclosing a large area of anchorage with wet and dry docks, and accommodation for four hundred vessels. A municipal charter was granted in 1884. There is a considerable trade in coals, timber, and provisions, and a large fleet of fishing boats is maintained. The long stretch of sands, extending southwards to Pegwell Bay, affords excellent bathing.

Ramus, PETER, otherwise PIERRE DE LA RAMÉE (1515–72), French philosopher, was in his youth a servant at the College of Navarre, and, being of a studious turn, managed to accumulate much learning, and eventually became a

notable scholar. He wrote voluminously, and in 1543 published a work against Aristotle's teachings which caused a sensation. It was suppressed, and its author prevented from teaching, but Henri II. restored him to his profession, and named him royal professor of rhetoric and philosophy. He wrote a great number of books, and his knowledge of languages was very great. He became a Protestant, however, and was twice obliged to leave Paris, and in 1572 was one of the victims of the massacre of St. Bartholomew. He was the best mathematician of his time in France, and translated Euclid. He was also an excellent orator and grammarian, and wrote various grammatical treatises. He it was who caused the introduction of the letters *j* and *v* into the European languages in place of the ancient *i* and *u*.

Ranch, a large herding or farming establishment in the western states of America or in Central or South America, especially a large stock-farm managed by a mess (Spanish *ranch*) of herders, the cattle-run being termed a range.

Randolph, THOMAS (1605?-34), poet, was born in Northamptonshire, and was a student at Cambridge University, on leaving which he came to London, where he made the acquaintance of Ben Jonson, who esteemed him. His dissipated habits, however, prevented his attaining the position he might have occupied, and led to his premature death. His sometimes excellent *Poems, Translations, and Plays* appeared in 1634, a second volume being published posthumously.

Ranelagh, a celebrated resort of the gay and fashionable world during the last half of the eighteenth century, occupied the grounds of Ranelagh House, Chelsea. Music and dancing were the chief attractions. The gardens were opened in 1742, and closed in 1804.

Rangoon, a district and seaport in the Pegu division of British Burmah. Since 1880 the district has been limited to the area of 22 square miles, in which the town is included. The latter stands on the left bank of the Hlaing or Rangoon river (a branch of the Irawadi) at the junction with the Pegu, 21 miles from the sea. The river harbour is accessible to ships of large draught, and a large trade is carried on, the exports being teak, rice, cotton, hides, petroleum, catechu, shellac, and tobacco, and the imports consisting of all kinds of European manufactures. Ship-building employs many hands. Rangoon was founded in 1753, taken by the British in 1824, and finally annexed in 1852.

Ranke, LEOPOLD VON (1795-1886), historian, was born in Thuringia, and in 1817 became professor of history at Frankfort-on-the-Oder. His first notable work was his *History of the Roman and Teuton Nations* (1824), and this gained him a professorship. In 1827 he published a still more important work, *History of the Princes and Peoples of Southern Europe in the 16th and 17th Centuries*. Obtaining leave of absence for a time, he made many researches in great Italian and other libraries for his best-known work, the *History of the Popes*,

which appeared in 1834-37. This has been often translated, but his greatest effort is considered to be his *History of Germany during the Reformation* (1839-47). In 1841 he was made royal historiographer, and to the day of his death continued to pour out his wealth of historical information, among his productions being excellent histories of England, France, and Prussia.

Ransom, through French "rançon" and Latin "redemptio," the price demanded or paid for the deliverance of captive or slave, or for the recovery of captured goods; the consideration for which punishment is remitted or restraint removed.

Ranunculaceæ, an order of thalamifloral dicotyledons comprising about 500 species in about 30 genera. With the exception of Clematis (q.v.) they are herbs, with radical or scattered leaves and flowers specially characterised by the absence of any cohesion or adhesion among their parts. These flowers are often monosymmetric, being nearly always nectariferous and insect-fertilised. They are pentamerous; but the petals are frequently absent or aborted, the stamens are indefinite in number, and the carpels may be one, two, three, five, or indefinite. The sepals are imbricate and deciduous, the petals and stamens hypogynous, and the seeds albuminous. The fruit is apocarpous and generally dry, consisting either of achenes (q.v.) or follicles (q.v.). Almost all members of the order have acrid properties, and they belong mainly to temperate and cold regions. Among the genera are Clematis, Anemone, Ranunculus, from which the order takes its name, and which includes the buttercups, Caltha, the marsh-marigold, Helleborus, including the Christmas rose, Aquilegia, the columbines, Delphinium, the larkspurs, Aconitum, and Pæonia, most of which have been treated separately under their English names (q.v.).

Rape, the general name for several races of *Brassica campestris*, cultivated for the sake of the oil in their seeds, and differing by constant characters from turnips or swedes. We import considerable quantities from India and Russia. In Germany three sub-races are recognised, each with summer and winter, or annual and biennial, varieties, differing in the colour of their radical leaves and in the size and colour of their seeds. These are *colza* (q.v.) with ruddy brown seeds, 1,000 of which weigh 29 grains; *rübsen*, with almost black seeds, 1,000 of which weigh 34 grains; and *rape*, with blue-black seeds twice as heavy as those of *rübsen*. The seeds yield from 30 to 45 per cent. of a sherry-coloured oil, with a specific gravity over .911, consisting of olein, stearin, and a third fat, almost peculiar to Cruciferae. Rape-oil is used for food in India and Germany; but elsewhere mainly for lubrication, mineral oils having largely superseded it as illuminants.

Raphael (otherwise RAFFAELLO SANZIO), was born at Urbino in 1483, being the son of a painter who, previous to his death in 1494, taught him the elements of his art. Raphael was left a small inheritance, and about 1495 (though some writers put

it at a much later date) began to take lessons in the studio of Perugino. There is much controversy about his earliest works, the influence of various masters discernible in them having led many to the opinion that he studied under several of them. But it is agreed that after 1504 he began an independent career as a painter, and, except for an occasional trace of the manner of Da Vinci and Michelangelo, his pictures henceforth showed more and more of his own individuality. In the year just mentioned he went to Florence, and in the following year was back again in Perugia. He began to obtain some excellent commissions, and in 1507 finished his *Entombment*, and worked at several fine frescoes. He moved frequently between Perugia and Florence, and in or about 1509 proceeded to Rome to decorate certain apartments in the Vatican to the order of Julius II. Here he did some of his grandest work, and commissions poured in upon him to such an extent that he was obliged to leave the execution of many of them to his pupils, who worked from his designs. The accession of Leo X. to the throne increased the commissions from the Vatican, for which some of his finest work was done. For it he did the magnificent cartoons illustrating the *Acts of the Apostles*, ten in number, seven of which are now in the South Kensington Museum, the other three having perished. One of his wealthiest patrons was Agostino Chigi, for whose villa at Trastevere Raphael completed various works. Besides his paintings and cartoons, Raphael is supposed to have been the architect of some splendid edifices, notably the Palazzo Pandolfini, and was appointed chief architect and inspector of antiquities at St. Peter's, where certain improvements have been attributed to him, but there is much doubt as to the extent of his architectural achievements. He never married, but was engaged to the niece of Cardinal Bibbiena, her early death preventing the nuptials. He died of fever at Rome on Good Friday, March 26th or 28th, 1520, and lay in state with his unfinished masterpiece *The Transfiguration* at the head of his bier. He was buried in the Roman Pantheon. The civilised world has unanimously accepted Raphael as one of the greatest, if not the very greatest, of all painters. There are several excellent examples of his work in the National Gallery, and others in the Vatican, Louvre, and Dresden galleries. The Sistina Madonna in the last-named town is considered his finest work.

Raphia, a strong and useful fibre obtained from the leaves of *Raphia Ruffia*, a palm cultivated in Madagascar, Mauritius, and neighbouring islands, and of *R. tædigeræ*, the Jupati palm, of Brazil. It comes into the market in strips $\frac{1}{4}$ to $\frac{3}{8}$ inch wide, and is worth from £40 to £50 a ton. It was mainly introduced as a substitute for Russian bast (q.v.) at the time of the Crimean War.

Raphides, a Greek word meaning "needles," applied strictly, in botany, to the slender crystals of calcium oxalate, belonging to the Oblique system, which occur in bundles chiefly in the cells of Monocotyledons. The term is, however, often extended to any crystals occurring within the plant,

those grouped in spherical clusters being distinguished as *sphaeraphides*.

Rapin, PAUL DE THOYRAS (1661–1725), French historian, was the son of an advocate, and was born in Languedoc. He became a student of law, but was driven from France by the revocation of the Edict of Nantes, and spent some years in England and Holland. He followed the Prince of Orange to Ireland, and fought at the battle of the Boyne and at Limerick, and in the latter place was seriously wounded. He retired to the duchy of Cleves in 1707, and there wrote his notable *History of England*, which appeared in eight volumes in 1724 at The Hague. This work has much merit, and is still valued by students.

Rapp, JEAN, COUNT DE (1773–1821). French soldier, was born in Alsace, and was intended for the Church, but joined the army in 1788, and served with great distinction during the revolutionary wars, signalling his valour in Germany and Egypt. Napoleon had a high opinion of his merit, and made him successively general of brigade, general of division and count. In 1819 he became a peer of France. His intrepidity was proverbial, and he was most amiable and gentle in private life, but possessed great sagacity and firmness.

Raschi, SOLOMON (1040–1105), French Rabbinical writer, was born at Troyes. His name of Raschi was formed of the first letters of Rabbi Scheloumon Ishak. His bent towards theology led him to study the Talmudic writings, and his comments upon them are held in great repute, and even reverence, by Jews. As an interpreter of the Talmud he had no equal, and he travelled widely in search of the special knowledge he required. He wrote much, among his writings being *Comments on the Pentateuch*, but his *Notes on the Talmud* (1520) constitute his chief work.

Rash. Certain febrile disorders are attended by characteristic cutaneous eruptions or rashes. These maladies are known as the exanthemata (small-pox, chicken-pox, scarlet fever, measles, typhoid and typhus fevers). The term rash is sometimes applied to other forms of skin eruption, as, for example, nettle-rash, and the rashes which are produced by the administration of certain drugs.

Rask, RASMUS CHRISTIAN (1787–1832), Danish philologist, was born of very poor parents, but was enabled to enter Copenhagen University. He made a special study of the Northern languages, and urged the importance of Icelandic literature. In 1816 he went on a tour in the East, and studied its languages, returning in 1823. In 1829 he was appointed professor of Oriental languages at Copenhagen. He had a most accurate and extensive knowledge of English, and produced in 1817 the first good Anglo-Saxon grammar. He published grammars of other languages also, and demonstrated the affinity between the Scandinavian and Latin, Greek, and Slavonic languages.

Raspberry (*Rubus Idæus*), a deciduous shrub belonging to the Rosaceæ, with biennial erect stems, known to gardeners as "canes," round and bristly; pinnate leaves, whitish beneath; white flowers; a persistent calyx; conical receptacle; and an etærio (q.v.) of red, amber, or white hoary drupels. It is a native of Great Britain, its English name referring to the rough aspect of the fruit. The fragrant fruit is largely used for dessert, tarts, jam, syrup, jelly, and vinegar.

Rastadt, a fortified town of Baden, on the Murg, three miles from its junction with the Rhine, and 12 miles from Carlsruhe. Commanding the roads through the Black Forest, it possesses great strategical importance, and has a large garrison. There are few local industries. The old palace of the Margraves is the only building of interest.

Rat, a name for the larger members of the Mouse family, sometimes used with an epithet to denote other animals, either allied to the true rats or in some way resembling them. There are two British species, the Old English or Black Rat (*Mus rattus*), with greyish or black fur on the upper surface, ashy beneath; length of head and body about seven inches, tail a little more; and the Brown or Norway Rat (*Mus decumanus*)—the "Hanoverian" Rat of Waterton—greyish-brown above, whitish beneath, head and body about nine inches long, tail seven inches or a little more. In both forms the tail is scaly; the Norway Rat has the head less elongated, a blunter muzzle, and smaller ears than the Black Rat. The former was introduced into England—probably from the East Indies—early in the eighteenth century, and has not only almost entirely displaced the Black Rat in this country, but has been successful in finding a footing all over the globe. The epithet "Norway" is a mistaken one; when it was first applied, the animal was not even known to exist in that country. Black varieties occur, but are readily distinguished from the true Black Rat by the shape of the head. The Black Rat seems not to have been known in this country before the middle of the sixteenth century. In habits, it agrees with the larger form, but is not so fierce, and the white and pied rats kept as pets are generally varieties of this species. The habits of rats are well known. They are nocturnal burrowing animals, extremely active and predaceous, feeding on whatever comes in their way and destroying any obstacle that bars their progress. In the *Field* of March 3rd, 1894, was given an illustration of some lead water-pipes through which rats had eaten their way. Stories are told of their attacking fat pigs, and when short of food they have been known to eat away horses' hoofs. They are extremely prolific; they breed at about six months old, producing four or five litters, of from four to ten young ones in each, in the year. The raptorial birds keep down their numbers in some degree, but traps and poison are also largely used. Waterton claimed to have rid his house of "Hanoverian" rats by covering with tar one he had caught in a trap and then turning it loose. [MUSK-SHREW, VOLE.]

Ratafia, OIL OF, an essential oil employed for flavouring purposes, and which enters into the composition of the liqueur of the same name.

Ratel, either of the two species of Mellivora, small bear-like Carnivores from India and Africa. The Cape Ratel (*M. capensis*), grey above and black beneath, is about the size of a badger. It feeds principally on bees and honey. The Indian species (*M. indica*), which Blanford considers doubtfully distinct, is said to disinter and feed on dead bodies. Both forms are easily tamed, and their habit of tumbling head over heels in captivity is very amusing.

Ratio is the relation between two quantities of the same kind. The ratio between A and B is generally written A : B, A being termed the antecedent and B the consequent term. The value of the ratio is obtained when it is found what multiple or part the one term is of the other. Since this can be found by dividing one by the other, the ratio

A : B can also be written $\frac{A}{B}$. Hence any ratio can

be expressed as a fraction. Since $\frac{A}{B} = \frac{\rho A}{\rho B}$, we

can state that the value of any ratio is unaltered if antecedent and consequent be multiplied by the same quantity.

Ration, a computed share, an allowance of provisions or forage for a fixed period issued to an individual by the commissariat department of the army or navy.

Rationalism, the principle of believing nothing which is not logically or scientifically demonstrable to human reason; the rejection of all mysteries, miracles, and authoritative dogmas as such; or in other words, the denial of the validity and merit of the faith of dogmatic theology.

Ratisbon (REGENSBURG), a city of Bavaria, and capital of the Upper Palatinate, stands on the right bank of the Danube, opposite the mouth of the Regen, 53 miles S.E. of Nuremberg. As a Celtic settlement it existed before Roman times, was erected into a bishopric in the 8th century, and became a free imperial city about 1200. A period of great commercial prosperity followed, but this had died out before the 'Thirty Years' War, in which it suffered severely. It was annexed by Bavaria in 1810. The cathedral, founded in 1275, is a fine example of pure Gothic style, and the Schotten-kirche, dating from the 12th century, is a curious Romanesque building. Imperial Diets were frequently held here, and the Ambassadors' Street still contains the houses of representatives. The principal manufactures are iron and steel goods, pencils, pottery, and parquet floors. There is a considerable trade in local produce, and boat-building flourishes.

Rattan. [CALAMUS.]

Rattazzi, URBINO (1810-73), Italian statesman, studied law at first, and afterwards became an advocate of note at Turin. After the 1848

revolution he entered political life, and became successively a minister, Vice-President of the Chamber of Deputies, and President (1852); was a member of Cavour's ministry, and after his death was again President of the Chamber. In 1862 he was Prime Minister, and again in 1866, and was distinguished for firmness and energy.

Rattlesnake, any individual of the genus *Crotalus*, with about fifteen species, mostly North



RATTLESNAKE.

American, though one (*C. durissus*) ranges to Brazil. The tail bears a rattle of horny rings, erroneously said to indicate the age of the snake, its years being supposed to correspond to the number of the rings. New rings are probably added when the skin is cast, but in all probability sloughing takes place more than once a year, as in our common snake. Rattlesnakes are generally nocturnal; they are extremely venomous, the bite generally proving fatal to man. They rarely attack unless provoked or in pursuit of food. The stories told of their powers of fascination are groundless; and the rattle seems to be used to warn off intruders rather than to entice prey or bring mates near. The coloration varies; it may be brownish, blackish, or yellow with dark spots, frequently bordered with yellow on the back and sides.

Raumer, FRIEDRICH LUDWIG GEORG VON (1781-1873), historian, was born in Anhalt, and studied at Halle and Göttingen. He became professor of history at Breslau and at Berlin, and was ambassador to the French Republic about 1848. His most notable works are *The History of the Hohenstaufen and their Times* (1823-25), and *History of Europe* (1832-50), but he wrote many others of merit.

Rauschbrand, SYMPTOMATIC ANTHRAX, a disease of cattle in which swelling often affecting one of the hind quarters ("black quarter" or "quarter evil") occurs. The disease is due to a bacillus which presents some resemblance to the bacillus of anthrax; it is, however, usually motile, and it can only be cultivated in the absence of oxygen.

Ravelin, in fortifications, a triangular work with two embankments forming a salient, projecting angle.

Raven (*Corvus corax*), a bird of the Crow family, widely distributed in the northern hemisphere, but becoming rare in Britain. The total length is about two feet, and the black plumage is in some parts varied with purple. The bill and legs are black. They still breed in some places along the south coast, but are more plentiful in the north. In a few cases they are protected in parks. They are useful birds in so far as they prey upon rats, but they attack feathered and furred game, and even lambs, so that gamekeepers and farmers combine to destroy them. The Raven plays an important part in folk-lore, and is the first bird mentioned by name in the Old Testament. It was sent out of the ark by Noah, but it did not return.

Ravenna, the capital of the Italian province of the same name, stands four miles from the shore of the Adriatic, with which it is connected by a canal, the rivers Ronco and Montone having silted up. Founded by Greeks, it was conquered by Rome about 191 B.C. Honorius transferred his court there in the 5th century, and, on its capture by the Ostrogoths, Theodoric took up his abode in a vast palace the name of which still remains. After many vicissitudes it became an independent republic in the 13th century, passing later into the power of the Popes, and being incorporated with Italy in 1859. There are 13 churches, including the cathedral, St. Vitale, and Sta. Maria Rotunda, which date from the 4th to the 6th century. The Roman Porta Aurea, the tombs of Honorius, Valentinian III., Dante, the pillar of Gaston de Foix, and the statues of the Popes in the market-place are among the many memorials of the past.

Rawal, or RAWAL PINDI, a division, district, and capital town in the province of the Punjab, British India. The division has an area of 15,435 square miles, and comprises the districts of Rawal Pindi, Jhelum, Gujerat, and Shahpur. The district, with an area of 4,861 square miles, lies on the slopes of the Himalayas, and consists of mountains divided by fertile valleys, along which torrents run down to the Indus or Jhelum. Agriculture is the only industry, save cotton-weaving, and the country is poor. The capital, standing half-way between the Indus and the Jhelum, is a well-built, modern place, and, being on the highway to Attock, Peshawar, and Cabul, has some military importance, and does a large transit trade, especially in grain.

Rawlinson, SIR HENRY CRESWICKE (b. 1810), was educated at Ealing, and entered the Bombay army, and served in India, Persia, and Turkish Arabia, holding several important diplomatic posts. He became most famous as a decipherer of cuneiform inscriptions, and published a great deal concerning them from 1836 onwards. He received many honours, and was elected a fellow of the Royal Society in recognition of his services to scholarship. Between 1858-65 he was a member of Parliament, and in 1891 was created K.C.B.

Ray, JOHN (1628–1705), great naturalist, was born in Essex and entered Cambridge University, where he greatly distinguished himself. He studied botany, his favourite pursuit, and travelled much, writing a great deal about the subject. In 1667 he became fellow of the Royal Society, and in 1670 published his great catalogue of English plants. He married in 1673, and subsequently issued his catalogue of English birds and fishes and other great works. He divided botany into its natural parts, and his system is now universally adopted. He wrote many religious works, the one entitled *The Wisdom of God in Creation* being the earliest attempt to prove the truth of revealed religion by reference to natural history.

Raynouard, FRANÇOIS (1761–1836), philologist, was born in Provence, and during the Revolution was imprisoned, only obtaining release after the death of Robespierre. His first notable literary success was a tragedy (1804), but he afterwards devoted his attention to early French literature, and published valuable works on the troubadours.

Rays (*Batoidei*), a section of Plagiostomatous fishes, in most of which the body is depressed, and forms with the large pectoral fins a nearly circular disc. [DEVIL-FISH, SKATE, STING-RAY, THORNBACK, TORPEDO.]

Razor-Bill (*Alca torda*), called also the RAZOR-BILLED AUK, a sea-bird common on the North Atlantic coasts and on rocky headlands in Britain. The total length is about eighteen inches; the plumage black, with a greenish gloss above, pure white below. The single egg, whitish with brown markings, is laid on the bare rock. The flesh and eggs are eaten.

Razor Shells, the popular name for the long razor-shaped bivalved shells which are common on sandy shores; they belong to the genus *Solen*.

Ré, or RHÉ, ÎLE DE, lies in the Atlantic, six miles from La Rochelle, the Pertuis Breton separating it from the French coast, and the Pertuis d'Antioche from the Île d'Oléron. It is 18 miles long by four broad, and has rocky shores but good anchorages. St. Martin and Ars are the chief towns. Salt, wine, oysters, and fish are the chief products. It was long occupied by the English before 1457, and was attacked by them in 1627. It is now strongly fortified.

Reade, CHARLES (1814–84), was born in Oxfordshire, graduated at Oxford, obtaining a fellowship at Magdalen, and studied law for a time. Feeling a desire to write for the stage, he produced his first play in 1850, but it was not a success. In 1852 appeared his earliest novel, *Peg Woffington*, which convinced the public that a distinctly powerful writer had arisen. He had studied the art of fiction for years before he attempted to publish a line. *Christie Johnstone* appeared in 1853, and was followed by *Never too Late to Mend* (1856), in which his purpose was to denounce certain horrors of prison life. For this and all his other novels with a purpose he read very largely. *The Cloister and the Hearth*, which is often looked upon as his

greatest work, came out in 1861. *Hard Cash* (1863) exposed the cruelties of private lunatic asylums, and *Griffith Gaunt* (1866) was believed by him to be his best work. He wrote *Ivul Play* in conjunction with Boucicault (1869), writing much for the stage meanwhile. Though he had the greatest faith in his power as a dramatist, the only truly successful play he wrote was *Drink*, an adaptation of *L'Assommoir*. He was a man of very strong opinions about literary property, and was generally at war with somebody or other. He is certainly one of the great English novelists of the century.

Reading. 1. An ancient market-town and municipal and parliamentary borough of Berkshire, on the left bank of the Kennet and the right bank of the Thames at their point of junction. It was a place of some importance when the Danes occupied it in 871, and in 1121 Henry I. founded the splendid abbey in which he was buried and of which there are but scanty ruins. There is a large trade in agricultural produce, and many hundreds of hands are employed in biscuit-making and seed-growing. Iron-works, engine factories, and breweries also exist. It sends one member to Parliament.

2. The capital of Berks county, Pennsylvania, United States of America, on the Schuylkill river, 58 miles north-west of Philadelphia. It is a great railway centre and the seat of the great engine works of the Philadelphia and Reading Company. It has also extensive iron-works, cotton-mills, distilleries, tanneries, etc., and carries on a large trade in coal. It is a healthy and well-built town, the population being largely German.

Real Estate. All property comes under one of two great divisions, viz. real or personal estate—"real" signifying freehold, and "personal" chattel property (including leasehold estate, which passes by the legal designation of chattels real). The foundation for these terms is to be sought in the respective remedies resorted to for the deprivation of either. As to real estate, the land itself had to be recovered, and as to personal estate, proceedings could be taken against the person only. [ASSETS, FREEHOLD.]

Realgar is a naturally-occurring sulphide of arsenic, represented chemically by the formula As_2S_3 . It occurs, frequently associated with lead, in the Hartz and other localities, forming fine orange- or ruby-coloured crystals belonging to the Rhombic system. It has a specific gravity of 3.5 and hardness 2. It is known also under the name of *ruby sulphur*, though the name is properly restricted to an artificial product of similar composition. It is employed to a small extent as a pigment, and also in pyrotechny for the production of white lights.

Realism, in philosophy, the metaphysical doctrine that universals really exist either apart from particulars, as Plato held, or that they are in particulars, as Aristotle held; or the combination of these views held by certain mediæval schoolmen. "Natural Realism," as held by Reid in opposition to Berkeley (q.v.), is the doctrine that the external world exists independently of

perception and is directly, and not merely symbolically, knowable. Scientific realism regards genera and species as really existing relations between really existing objects, and also as concepts of such relations, so that the same name represents both the relations and the concept of the relations. [IDEA.] In literature and art realism, called also naturalism, is the theory that what actually exists and is actually true ought to be represented without any reticence and selection, which has in some cases induced nauseous delineation of what is vicious and revolting. This phase is a reaction against idealism and romanticism.

Reaping, the cutting of ripe grain-crops for harvest with a sickle or other cutting instrument or machine. A reaping-machine as distinguished from a mowing-machine bends the corn over the knives and discharges the swathe at intervals in sheaves, and apparatus for binding the sheaves is often attached.

Réaumur, RENÉ ANTOINE FERCHAULT DE (1683–1757), scientist, was born at La Rochelle, and was educated chiefly by Jesuits. He first wrote upon mathematics, but turned his attention to natural philosophy and natural history, and produced various important treatises on the manufacture of porcelain, the silk of spiders, the tinning of sheet-iron, etc., and made a great improvement in the thermometer, which has been named after him. His valuable *History of Insects* (1734–42) was left unfinished by him.

Réaumur Thermometer differs from the Centigrade in having 80° as the boiling-point of water instead of 100°, the zero in both cases being the temperature of melting ice. Hence 80 degrees on a Réaumur thermometer correspond to 100 degrees on a Centigrade, and 1 Réaumur degree is equivalent to $1\frac{1}{4}$ Centigrade degrees. This thermometer is named after the celebrated French physicist Réaumur (q.v.), and has been most generally used in Germany.

Rebecca Riots, disturbances caused about 1843 by a secret society in Wales called "Rebecca and her Daughters" (Gen. xxiv. 60), formed for the destruction of toll-gates, the number of which was a grave abuse. The members went about at night in parties, often on horseback, dressed in female attire.

Recamier, JEANNE FRANÇOISE, MADAME DE (1777–1849), was born at Lyons, where her father was a notary, and married at the age of 16 a rich Parisian banker. She formed a *salon* in Paris, which was frequented by the most celebrated people of the time; but, as political conspiracies were considered her object, she was forced to leave Paris, and spent some time in Lyons and Italy. After the fall of Napoleon she returned, and wherever she went a crowd of flatterers followed. Her correspondence is full of valuable information about her contemporaries.

Receipt, a formal acknowledgment in writing of the payment or delivery of a specified amount

of money or of property of any kind, with date, name of depositor, signature of recipient, and any other relevant particulars. Also in popular use as a substitute for the medical *recipe*, so called from the first word ("take") of a prescription, a formula or set of instructions for producing a specified object or result.

* **Receiver**, a person appointed by a court to take charge (pending litigation) of the produce or rent of some property, or to manage the property in question.

Receptacle, a term variously employed in descriptive botany, but mostly used for the axial portion of a capitulum (q.v.) or of a single flower. The former is distinguished as a *common receptacle*—one, that is, common to a whole inflorescence; and the latter as the *floral receptacle*, *thalamus*, or *torus*. The internodes of the latter are not generally elongated; but, when elongated, the internode between the calyx and corolla is termed an *anthophore*; that between corolla and stamens, a *gynandrophore* (q.v.); that between stamens and carpels, a *gynophore* (q.v.); and that between the carpels a *carpopore*, as in the Geraniaceæ and Umbelliferae (q.v.). Other modifications of, and outgrowths from, the receptacle are known as the *disk*. This may be represented, as in the Cruciferae (q.v.), by separate glandular outgrowths excreting honey, and included, therefore, under the head of *nectaries* (q.v.), or they may be fleshy cup-like or ring-shaped bodies. Thus in *Victoria regia* (q.v.) the receptacle grows up round and imbeds the ovary, making it *inferior*, and carrying calyx, corolla, and stamens on an *annular* or ring-shaped disk, making them strictly *perigynous*; in *mignonette*, there is a fleshy one-sided plate within the corolla bearing the stamens and ovary, and thus *hypogynous*; in the orange group, it is a cushion-like mass below the ovary; in the peony, it is a cup enclosing the carpels; in *Alchemilla*, a perigynous fleshy ring round the inner surface of a tubular receptacle or "calyx-tube;" and in the Umbelliferae, an *epigynous* cushion carried to the top of the carpels by the adherent (*i.e.* superior) calyx-tube. It is thus mainly dependent upon the receptacle whether the so-called "insertion" of the petals and stamens be hypogynous, perigynous, or epigynous—a point of primary importance in classification.

Reciprocity, in commerce, equality of privileges as to all, or some, imports and exports between the subjects of any two governments, established by treaty.

Recognisance is an acknowledgment upon record of a former debt. He who so acknowledges such debt to be due is termed the recognisor or cognisor, and he to whom or for whose benefit he makes such acknowledgment is termed the recognisee or cognisee.

Recoil is the backward motion of a gun and its carriage when the gun is fired. The force of the explosion tends to drive the gun backwards just as much as it tends to drive the projectile forwards; but the latter, being lighter and having

less friction to overcome, travels a great distance, whereas the heavy gun is forced only a few feet back. The arrangements of gun and carriage are generally such that after the recoil the gun returns to its former position, but in older forms it was the gunner's work to replace the gun after each discharge. The recoil of a rifle is generally known as the "kick," and is felt as a blow on the shoulder by the person firing it. Other things remaining unchanged, the velocity of recoil of a gun is proportional to the charge of powder.

Record is an authentic testimony in writing contained in rolls of parchment and preserved in courts of record. The record of *nisi prius* is an official transcript or copy of the proceedings in an action entered on parchment, and sealed and passed, as it is termed, at the proper office. It serves as a warrant to the judge to try the cause, and is the only document at which he can judicially look for information as to the nature of the proceedings and the issues joined between the parties.

Recorder, a barrister or other person learned in the law associated with the mayor or other magistrate of any city or corporate town (having a jurisdiction or a court of record within its precincts) for his better direction in the judicial proceedings of such court. Thus the Recorder of the City of London is practically the judge in the Lord Mayor's court of the City, although in theory the Lord Mayor and Aldermen are the judges therein.

Records, authentic registers or instruments, authoritative copies of documents, or official accounts of transactions or occurrences, such as are preserved in the Rolls Office and the Record Office (whose head is the Clerk of the Records), in courts of justice, or in the archives of corporations or public institutions.

Recovery of Land. This is the present title of an action for recovery of possession of land, which has taken the place of the old action of ejectment under the Judicature Acts, and it lies in all cases where an action of ejectment formerly did. [EJECTMENT.]

Rectification, a term applied to the purification of liquids, chiefly of organic liquids, spirits, etc.; the purification is effected usually by fractional distillation, frequently with some solid previously added to the liquid to retain some of the impurities present. [DISTILLATION.]

Rectum, the terminal portion of the alimentary canal, which pursues a fairly straight course from the lower end of the sigmoid flexure of the large intestine to the anus.

Diseases of the Rectum. *Fistula* and *prolapse* have already been dealt with; the subject of *piles* has also been alluded to. *Stricture of the rectum* may be fibrous or malignant; the chief symptoms are pain and constipation, with occasional passage of narrowed ribbon-like motions. The form of malignant disease (*cancer*) that usually affects the rectum is epithelioma. In addition to the obstructive symptoms already mentioned, the occurrence

of bleeding and the manifestation of general signs of cachexia are common symptoms in this condition. Treatment may consist in excising the new growth if the disease is limited, or the operation of colotomy may be indicated if excision is impracticable and if the symptoms of stricture assume prominence. The rectum is sometimes affected by *polypus* or by *ulceration*. Anal ulcer or *fissure* is a very distressing complaint, which, happily, is readily cured by proper treatment. *Pruritus ani*, the condition of irritation or itching about the anus, is a common and troublesome malady. It may be due to threadworms or to pediculi, and may be associated with piles or with the gouty diathesis. If there be no removable local cause, treatment consists mainly in administering salines, the promotion of action of the skin, and the use of ointments.

Red. [PIGMENTS.]

Redbreast. [ROBIN.]

Red Cross, the badge of the Knights Hospitallers (q.v.), of the order of St. John of Jerusalem, and of the modern revival of the English "language" of that order as a society for ambulance service, and of similar foreign societies. The red cross has been internationally recognised as a symbol of neutrality at the Geneva Convention of 1864. The *Order of the Red Cross* was instituted in 1883. It is conferred upon ladies who have distinguished themselves in tending the sick and wounded, and is bestowed on the recommendation of the Secretary of State for War.

Red Deer (*Cervus elaphus*), a large deer from Europe and Western Asia, and North Africa if the Barbary Deer be, as is probable, a mere variety. In England the Red Deer is wild on Exmoor; it is also found in the north of Scotland and the west of Ireland. The male is called a stag, and the female a hind. A full-grown stag stands about four feet high at the withers; the neck is greyish, the body reddish-brown, and the rump is marked with white. Only the males bear antlers, which show signs of growth in the first year, appearing in the second year as unbranched beams; the first branch is gained in the third year, and when twelve are present the animal is known in Scotland as a "royal stag." The antlers are shed in spring. The wild deer of Exmoor are hunted with horse and hound (with a close season from May 11th to August 11th, and from October 9th to March 24th). In Scotland they are stalked and shot with a rifle.

Red-Eye (*Leuciscus erythrophthalmus*), a British fish allied to the Roach (q.v.). Its name refers to the colour of the iris, and it is also called Rudd from its red fins.

Redia, a stage in the life-history of the Liver Flukes (Trematoda) when the animal lives in the body of pond-snails or fish. They may give birth to other series of rediæ or to a free-swimming tailed form known as the Cercaria.

Reding, ALOYS, BARON VON (1755-1818), Swiss patriot and soldier, is remembered for his gallant

defence of his country when the French invaded it in 1798. He was defeated and imprisoned by Bonaparte, whom he cordially detested, but was liberated after a few months.

Red-Lead is an oxide of lead represented by the formula Pb_3O_4 . It has been known from early times, and was formerly known as *minium*, but was only partially distinguished from cinnabar and realgar. It is prepared by carefully heating litharge [LEAD] in reverberatory furnaces with air-supply until the oxidation of the litharge has gone on sufficiently; but its brilliancy, and hence its value as a pigment, can be much diminished by insufficient care during this oxidation. It forms a bright red or scarlet powder which is largely employed as a pigment, also in the manufacture of flint glass.

Red-Poll, RED-POLE. [LINNET.]

Red River, a name given to many streams, the most noteworthy of which are:—(1) The Hoang-Kiang or Songcoi in Tonkin. (2) The Natchitoches, which rises in Texas and, after a course of 2,100 miles, being navigable throughout more than half of its length, debouches into the Mississippi. (3) Red River of the North, rising in Elbow Lake near the sources of the Mississippi, and, after a course of 565 miles, emptying itself into Lake Winnipeg.

Red River Settlement was founded on the last-named stream by the Earl of Selkirk in 1813 as a refuge for the surplus population of the Scotch Highlands. Much opposition was raised to the colony, but through the exertions of the founder it survived, and in 1835 the territory, with a mixed population of 5,000, including many French-Indian half-breeds (Bois-Brûlés), was retransferred to the Hudson's Bay Company. In 1869 the settlement was given over to the Canadian Government, when the French half-breeds under Louis Riel revolted and endeavoured to set up a republic, but the movement collapsed.

Red Sea, THE, stretches south-east from the heads of the Gulfs of Suez and Akaba to the Straits of Bab-el-Mandeb and the Gulf of Aden, a distance of about 1,200 miles. Its width is from 115 to 200 miles, except at the two extremities. The depth in the middle is about 1,200 fathoms, and it grows shallower towards each end, there being only 200 fathoms in the Strait. The bed is gradually being upheaved. As it receives no rivers, it is much affected by evaporation, and is salter than the ocean. The coasts on each side are fringed with enormous coral reefs, those on the east being the largest and most dangerous. The climate is one of the hottest in the world, but violent storms are infrequent. Submerged islands are the chief source of danger to vessels. Good harbours are few, Mocha, Yenbo, Hodeida, and Lokeyyah being the best on the Arabian shore, whilst on the African side are Massowah, Khor Nowarat, and Suakim.

Red Snow, an unicellular alga belonging to the order Protococcaceæ, which contains a considerable proportion of red colouring-matter, and covers large

tracts of snow in arctic or alpine regions in very short spaces of time. It is variously known as *Protococcus*, *Palmella*, and *Chlamydomonas, nivalis*. Its cells are about .004 millimetre in diameter, and may contain some chlorophyll in addition to their red pigment *palmellin*. By absorbing the heat-rays this plant seems to bring about the melting of the snow. One allied form (*P. cruenta*) occurs at the base of damp walls, and another (*P. prodigiosa*) on bread, meat, etc.

Redstart (*Ruticilla phænicea*), a European warbler migrating southward in winter. About the middle of April it visits Britain, remaining to breed, and since 1885 it is recorded as having bred in County Wicklow, Ireland. The adult male bird is a little more than five inches long, and has the forehead white, the throat black, the upper surface dark grey, and the breast, sides, and tail rust-red, whence its popular name (from Anglo-Saxon *steort*, "a tail") and its local name Firetail. It is an insect-eating bird, and the young are fed on caterpillars. The nest, of moss and dry grass lined with hair and feathers, is usually made in holes in trees, walls, or rocks, and the eggs are from five to seven, greenish-blue with faint red spots. The Black Redstart (*R. titys*), also a British visitor, has a more limited range.

Redwing (*Turdus iliacus*), a bird allied to, but somewhat smaller than, the Common Thrush, which it resembles greatly in plumage, but the under wing coverts are red. It visits Britain in the winter, returning northwards in the spring.

Reed. 1. A term applied to several species of large aquatic grasses, and extended to members of other orders, such as the bulrushes (*Scirpus*) among the sedges, and the bur-reed (*Sparganium*) and reed-mace (q.v.) among the Typhaceæ. The common reed (*Phragmites communis*), the largest British grass, common throughout the northern hemisphere, has stems from 5 to 10 feet high and plume-like panicles of flowers. It aids in binding together soil, impeding river denudation, causing the deposition of sediment and contributing to peat. Reeds were formerly used for arrows and musical instruments, are still cut into pens in the East, and are largely employed as thatch.

2. In acoustics, a contrivance for breaking up a continuous current of air into a succession of discontinuous puffs, which generally occurs in the form of a tongue placed over a rectangular orifice in a pipe. The current of air can only enter the pipe through this orifice, and when the tongue is flexible the rate of vibration of the column of air controls that of the reed; this is the case in the clarinet and oboe. When the tongue is stiff, as in the organ, its vibrations control those of the pipe; to get the best result the length of the tongue should be such that its natural rate of vibration corresponds to that of the fundamental note of the pipe or one of its overtones. If the reed can pass to and fro through the orifice it is said to be *free*, and such reeds occur in instruments like the harmonium or concertina. When the reed covers the slit so that it cannot pass through it, its vibrations

merely open and close the orifice, and it is known as a *beating* reed; this is the form usually occurring in organ pipes, and is specially used for the trumpet stop. The pitch of beating reeds rises as the pressure of the wind is increased, but the pitch of free reeds remains unaltered. Temperature affects reed pipes by altering the elasticity of the tongue, the note becoming flatter as the temperature rises.

In the clarinet and bassoon the tongue is generally a piece of cane, while in the bugle and trumpet the lips of the artist act as the reed.

Reed Bird. [BOBOLINK, WARBLER.]

Reed-Mace, or CAT'S-TAIL, the popular name of the two British species of the genus *Typha*, often erroneously called bulrushes. They are aquatic monocotyledons, with very long distichous linear leaves and a cylindrical tapering spadix, the lower part of which is a brown velvety mass of female flowers and the upper deciduous portion a slender, tapering spike of male ones. The perianth is represented only by tufts of hair, and the fruit is an achene with one pendulous albuminous seed.

Reefs. [CORAL-ISLANDS.]

Reel, a lively dance in duple time, performed by two or three couples; it consists of various circling or entwining figures. It is very popular in Scotland.

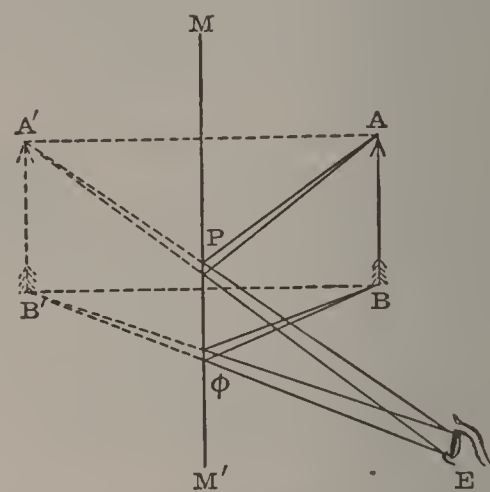
Reeves, JOHN SIMS (b. 1822), eminent singer, was born in Kent, and first appeared on the stage when in his 18th year. He was chiefly trained by T. S. Cooke. In 1841 he joined the Drury Lane company under Macready, and in 1843 travelled on the Continent, studying at Milan and Paris. He returned to England in 1847, and sang in opera for many years. Since 1860 he has been famous for his rendering of ballads, in which he was perhaps unequalled. In 1891 he retired, only appearing again in public on very rare occasions.

Reeves's Pheasant. [PHEASANT.]

Referendum. In the assemblies of the old Swiss Confederation and of certain cantons the delegates were required to refer certain questions (generally financial) to their governments before deciding them. In this century the name has been transferred to a provision of nearly all the Cantonal Constitutions and the Federal Constitution since 1848, which was first known as the veto, and is probably largely due to Rousseau's teaching. Any constitutional amendment must be submitted to a popular vote before becoming law; so must any Bill which has passed the legislature provided a certain number of citizens sign a demand within a certain time (50,000 citizens within 90 days, for the Federal referendum). M. Numa Droz, an eminent Swiss Radical, calls the institution a "legislative phylloxera;" and of 23 Federal referenda of a possible 144, 1848-91, 14 had resulted in rejection. Many English publicists advocate it for the United Kingdom.

Reflection. Radiation falling upon any bright

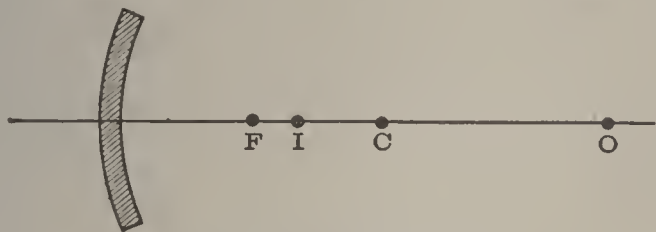
surface is either partially or totally reflected, according to the nature of the surface. It will be simplest to consider the reflection of that particular form of radiation which we call light. If we let a beam of light fall upon a polished surface—say, a plane mirror—we shall note that the reflected beam and incident beam are in the same plane with the normal to the mirror at the point of incidence, and both beams make the same angle with this normal. If the mirror be perfectly smooth and bright, it would only be able to reflect light in this regular manner; hence it would give us images of other bodies, but would itself be invisible. Bodies, however, do not usually reach this state of perfect



REFLECTION (Fig. 1).

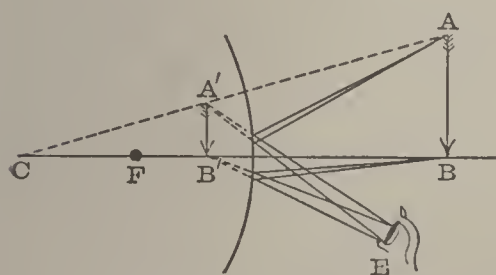
polish, but irregularities in the surface cause the light to be irregularly reflected. Every incident ray is reflected according to the above laws, but differences in inclination of a multitude of small surfaces making up the whole, produce the effect of the light being reflected in all directions. This is what is known as *diffusion* of light, and it is in virtue of this that a body becomes visible. A plane mirror produces an image behind it exactly similar in size and shape to the object in front. Thus, let AB be an object in front of a mirror, MM' (Fig. 1). A pencil of rays, AP, starting from A, is reflected in the direction PE, and appears to the eye (E) of an observer as though it came from a point A'. Similarly the pencil Bphi is reflected so that the reflected rays seem to start from B'; and every point in AB similarly sends out beams of light, the result being the formation of the image A'B', which is virtual, since the rays PE, etc., do not actually pass through it. It is easy to show that AB and A'B' are equal and equidistant from MM'. An image formed by a plane mirror is not a facsimile of the object; thus an image of the page of a book bears to the page itself the same relation as the type does to the actual print. If two mirrors be placed parallel to each other, an infinite number of images will be formed of an object between them, and a symmetrical arrangement of images is always formed when the angle between two mirrors is an aliquot part of 360°. This principle is employed in the kaleidoscope (q.v.) Mirrors are often made spherical in shape, and in this case an image is formed which is usually not so sharply defined as in the case of a plane mirror. This is due to

spherical aberration (q.v.). In the case of a *concave* mirror, when the object (O) is farther away from the mirror than the centre of curvature (C), the image (I) is smaller than the object, and is formed between C and a point (F) half-way between C and the mirror (Fig. 2). As the object moves towards C, the image, which is real and inverted, moves



REFLECTION (Fig. 2).

to meet it, so that both coincide at C. As an illustration of this, a man may so arrange matters that his hand may appear to be shaking its own image. If the object be between F and the mirror, the image is behind the mirror, is erect and virtual.



REFLECTION (Fig. 3).

If an object, AB, be placed in front of a *convex* mirror, the image A'B' is behind the mirror, and is virtual and erect. This is shown in the accompanying figure (Fig. 3), and the construction is equally

easy for the cases quoted previously with regard to a concave mirror. Concave mirrors are often used for medical purposes, since light can be concentrated on any special object by means of them. They are also used in reflecting telescopes. Convex mirrors are not often employed.

Reform, in English politics, *specifically* the removal of abuses and restrictions relating to the election of parliamentary representatives, tending to place the franchise on a more democratic basis. The first Reform Bill of 1832, demanded by a genuine and impressive display of public feeling, increased the representation of large towns, abolished many small borough constituencies, in which election was determined either by bribery or the will of an influential person, and extended the franchise. In 1849 and 1866 Lord J. Russell introduced Reform Bills, which were thrown out. In 1867 Mr. Disraeli got a Reform Bill passed which gave household suffrage in boroughs and lowered the qualification for the county franchise. In 1884 Mr. Gladstone's Government introduced a Reform Bill, which virtually established manhood suffrage, in connection with a Bill for the Redistribution of Seats. The Ballot Act and the Acts for the suppression of corrupt practices at elections were also measures of reform. The subject is not yet exhausted.

Reformation, in Church history, the great movement in favour of reform in the doctrine and practice of the Latin Church which resulted in the establishment of Protestant Churches in the sixteenth century. The Paulicians in Bulgaria, Italy,

and Spain, the Albigenses (twelfth century) and Waldenses in France, Wyclif (q.v.) in England, and Huss (q.v.) in Bohemia, had all exhibited the spirit of Protestantism in various degrees and directions; but no sect successfully maintained its ground against the Papal power until Leo X., in 1517, by the sale of indulgences [JUBILEE], provoked Martin Luther (q.v.) to revolt. He was supported by the princes of Saxony, Hesse, Brandenburg, and other German states, his teaching being formulated (1530) at the Diet of Augsburg in the Confession of Augsburg, drawn up by Melancthon, and in 1552, after a long struggle, the Emperor was forced to acquiesce in Protestants enjoying a fair amount of religious equality throughout Germany. Soon after Luther's demonstration at Wittenberg, Zwingli inaugurated the Reformation at Zürich, whence it spread over several cantons of Switzerland. After Zwingli's death Calvin (q.v.) and Farel took the lead at Geneva in 1536 of the Swiss Protestants; while in 1528 Martin Bucer (q.v.) introduced Lutheran doctrines into Strasburg. Meanwhile the movement spread far and wide, and took a firm hold on Scandinavia and the Low Countries. It gained a footing in England in the reign of Henry VIII., and rose finally into the ascendant on Elizabeth's accession in 1558; while John Knox preached its doctrines in Scotland from 1560 with such effect that Papists soon fell into a minority. The tide reached its flood soon after the last date, and by 1570 the Jesuits brought about the re-establishment of Papal ascendancy in Austria, Bavaria, the Tyrol, and regained some lost ground in Germany, the Low Countries, France, and the Peninsula.

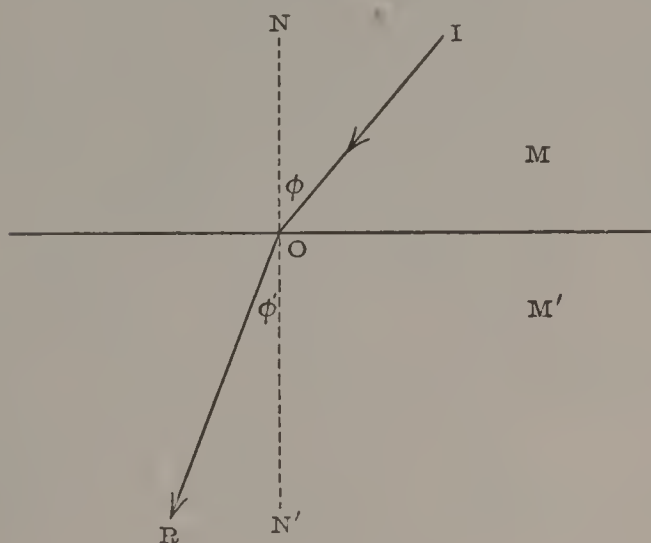
Reformatory, an institution for the reclamation, by discipline, instruction, and moral influence, of youths who have begun a vicious or criminal course of life and whose homes or haunts are considered to be likely to exercise evil influence. Sometimes juvenile offenders are sentenced to be detained for a specified term in a reformatory which is under State control.

Reformed Churches, the name given to the Protestant Churches which originally followed Zwingli and Calvin as distinguished from Lutheran congregations. In the United States the term is applied to the Dutch churches which formed a union in 1770, resettled in 1812; to the German Calvinists organised in 1747; and to an Episcopal Church founded in 1873.

Reformed Presbyterians, or CAMERONIANS, a body of Presbyterians in Scotland established in 1687. It was not until the year 1863 that they formally severed themselves from the Church of Scotland.

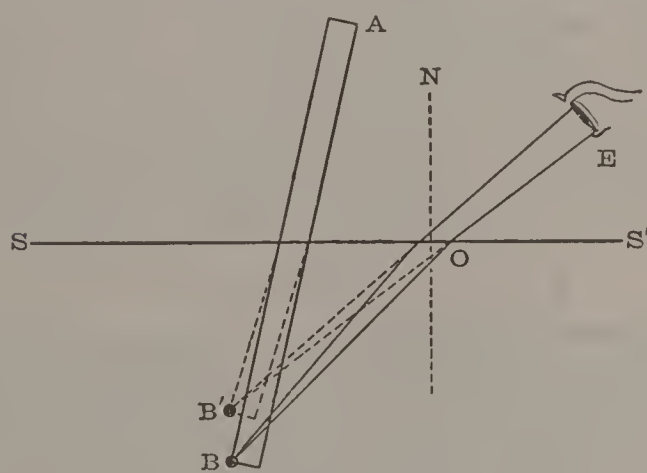
Refraction signifies, in *optics*, the changing of direction which a ray of light undergoes when it passes from one medium to another, and is due to the fact that the velocity of the waves of light is different in the two media. If IO be the incident ray in a medium M (Fig. 1), it is found that the refracted ray OR is bent nearer the normal N N' when the medium M is denser than

the first. Hence ϕ' is less than ϕ . But the sines of ϕ and ϕ' are proportional to the velocities of light in the two media; so $\frac{\sin \phi}{\sin \phi'}$ must be constant for the same two media. Experimentally, the ratio $\frac{\sin \phi}{\sin \phi'}$ has been shown to be constant, and this constant is generally represented by the Greek letter μ when the first medium M is air; μ is then called the index of refraction of the second medium M' . Let a pole, $A B$, be plunged into some liquid—



REFRACTION (Fig. 1).

say, water—whose surface is $s s'$ (Fig. 2). A pencil of rays, $B O$, will be bent away from the normal after emergence, and will appear to the eye (E) of an observer as though they came from a point (B') in



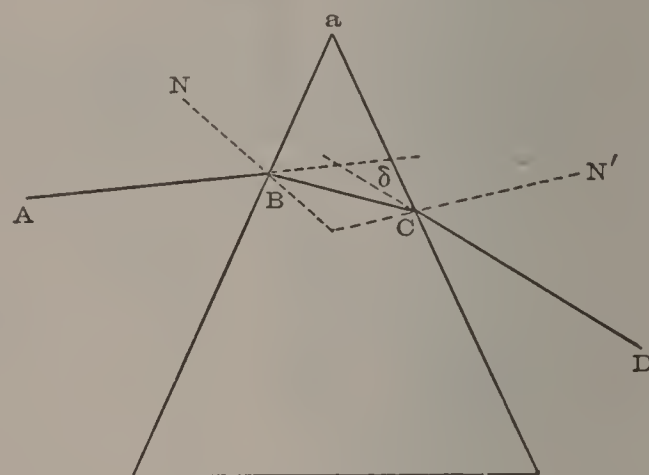
REFRACTION (Fig. 2).

the water above B . The bottom of the pole will thus appear to be lifted up, and this will apply to all the points of the pole which are in the water. The final result, therefore, will be to give the pole the appearance of being suddenly bent at the surface of the water. When we view the bed of a clear stream, refraction causes it to appear higher up; hence clear water always looks shallower than it really is. When a ray of light passes through a prism it is bent in its course away from the edge of the prism, and the deviation (δ) produced is the angle between the incident ray $A B$ and that which finally emerges, $C D$. This deviation is a minimum when the ray passes symmetrically through the prism—*i.e.* makes equal angles with the two faces of the prism. If a be the angle of the prism (Fig. 3) and δ' the

minimum deviation, it can be shown that the refractive index (μ) of the substance of the prism is equal to

$$\frac{\sin \frac{a + \delta}{2}}{\sin \frac{a}{2}}$$

which result is of great practical importance in finding the refractive indices of many substances, the portion of minimum deviation being easily obtained. The use of refraction for obtaining enlarged images of minute or distant objects is enormous, and for this purpose many forms of lenses are used. The effect of these upon light is more fully discussed in the article LENS. When



REFRACTION (Fig. 3).

light is refracted through most crystalline substances it gives rise to two different rays passing in different directions. This is known as the phenomenon of double refraction. [POLARISATION.] Although our most general experiences of refraction are obtained with regard to light, yet the phenomenon is exhibited by all kinds of radiation. The large waves of electrical disturbance have different velocities in different media, in the same way as have the minute waves of heat, and it is this difference of velocity which determines the phenomenon of refraction.

Refrigeration of a body is the loss of heat which it may undergo, its temperature being lowered in consequence. For a long time it was believed that rarefaction was alone sufficient to produce a lowering of temperature in a mass of gas, but it has been demonstrated by the experiments of Gay Lussac, Joule, and others that refrigeration will not be produced unless the gas expands against pressure—that is, unless it does work—and the loss of heat experienced is exactly equivalent to the amount of work done. Loss or gain of heat occurs when a body changes its state [LATENT HEAT], and this fact is practically employed in the artificial production of cold. Machines for the production of ice are known by the name of refrigerators, one of the commonest being that of M. Carré. Two strong metal cylinders A and B are connected by a metal tube, the whole being perfectly air-tight. Into A is placed a solution in water of ammonia gas. All the air is driven out of the apparatus, and the solution in A is heated, while B is cooled by running water. Ammonia gas is driven over from

A to B, and soon condenses in B under its own pressure. After a suitable time, A is removed from the source of heat and is placed in cold water, while B is placed in connection with the water which it is required to freeze. This is suitably effected by having B in the form of a hollow jacket, capable of allowing a cylinder of water to be placed in its centre. As A cools, the ammonia is rapidly re-absorbed, the liquid ammonia in B volatilises, and thus seizes heat from surrounding bodies. The water in the central cylinder is the nearest body to supply this heat; it thus becomes itself intensely cold, and hence freezes. In "cold-air machines" air is compressed by a pump, cooled to the lowest convenient temperature (generally by cold-water circulation), and then allowed to expand against the atmospheric pressure. In so doing it takes up an amount of heat equivalent to the work done, and hence cools the surrounding bodies. This method is used for cold storage on board ship, etc. Artificial cold is also often produced by means of freezing mixtures (q.v.).

Regalia, ensigns of royalty which are displayed or used at coronations, such as crowns, sceptres, orbs, swords of state, the ampulla, and spurs. The regalia of England are kept in the Jewel Room of the Tower of London, those of Scotland in the Crown Room of Edinburgh Castle. The term originally meant the prerogatives of the sovereign, being the plural of the Latin *regale*, "a royal right," also called *jus regale*. These include in Great Britain and Ireland the prerogatives of the administration of justice, of making war and concluding peace, of the right to unowned goods, of taxation, of minting, and of supremacy in affairs ecclesiastical.

Regelation. [ICE.]

Regenerators are large chambers used with gas furnaces in order to make use of the heat which is carried away by the products of combustion and would otherwise be lost. These gaseous products pass through chambers partially built in with bricks, and so heat these chambers to a very high temperature. The direction of the currents of gas and air to the furnace is then reversed so as to pass through this heated regenerator before combustion, while the gaseous products pass through another similar chamber. In this way the heat produced by the burning of the gas is greatly increased, and the application of these regenerators effects a very considerable economy in the fuel necessary.

Regent, a ruler, especially one who exercises sovereign authority during the minority, absence, or disablement of the sovereign of a state. The most notable regents in British history are the Duke of Gloucester (1422-47), George, Prince of Wales (1811-20), and in Scotland Murray (1567-70). The Protectors Somerset and Warwick in the reign of Edward VI. were members of a Council of Regency. At the old universities the term is applied to a resident graduate who takes part in the management of university affairs; but at Cambridge it is obsolete.

Reggio, a province and its capital in South

Italy. The former was known as Calabria Ulteriore Prima, and has an area of 1,515 square miles. The city (classic Rhegium) stands picturesquely on the Strait of Messina, surrounded by gardens and orchards outside its turreted walls. An earthquake destroyed the place in 1783, and it has been rebuilt on a modern plan. The harbour is fairly good, and olives, wine, oil, citrons, essences, silks, and grain are largely exported.

Reggio nell' Emilia, a province and its capital, formerly included within the duchy of Modena. The city is on the river Crostolo, 17 miles south-east of Parma, and is a prosperous and cheerful place. As Regium Lepidi, it was probably founded by Æmilius Lepidus, the maker of the Via Æmilia. A republic from 1100 to 1290, it then fell into the hands of the D'Este family, but attached itself to Piedmont in 1859. Chief among its public buildings are the Piazza Maggiore, the cathedral (mainly of 15th century), the basilica of St. Prospero, and the municipal palace.

Regiment, the largest division of an army which is permanently organised under its own special commander, who has the rank of colonel, regiments being grouped into brigades (q.v.), as may be convenient, and subdivided into squadrons (of cavalry) or battalions (of infantry). The strength of a regiment varies from about 500 to about 1,000 men; but the Royal Artillery constitutes one very large regiment divided into brigades.

Regiomontanus, otherwise JOHANN MÜLLER, a noted astronomer, born in 1436 at Königsberg. He studied at Leipsic, and, after assisting Purbach in Vienna, went to Italy, whence he returned to Vienna and accepted a professorship. He built an observatory and founded a printing office at Nuremberg, became Archbishop of Ratisbon and died in 1476. Besides writing some astronomical works, he reformed the calendar at the request of Pope Sixtus IV.

Registers, in music, series of notes of similar quality produced in a similar manner within the compass of a voice or of an instrument: as the head register and chest register of a human voice, the *chalumeau* of a clarinet.

Registration, the entry in a book of statements or memoranda as to certain facts which serve as memorials or evidence of those facts. Some registers are public, and others, such as the registers of shareholders, mortgages, etc., required to be kept by joint-stock companies, are private. The place or office where a public register is kept is called a registry, the act or system is called registration, and the officer who keeps the register is called the registrar. There is, as may be supposed, an almost infinite variety of subjects to which the system of registration is applicable; but perhaps the most important and popular one is that relating to births and deaths, which is now regulated by statute, but was formerly the subject of ecclesiastical cognisance only.

(1) *As to Births*. Every registrar is authorised and required to inform himself carefully of every birth which shall happen in his district, and to

learn and register, as soon after the event as possible, such particulars as are required by the schedule annexed to the Births and Deaths Registration Act, 1874, to be registered touching such birth; and it is the duty of the father and mother of any child born alive—or, in their default, of the occupier of the house (if he knows of the birth), and of each person present thereat, and of the person having charge of the child—within forty-two days after the day of such birth, to give to the proper registrar information concerning such birth, and in his presence to sign the register. Where a period of three months from the birth of the child has expired registration may still take place; but in this case a solemn declaration before the superintendent-registrar as to the truth of the particulars required must be made by one of the persons on whom the statute imposes the duty of giving information as to the birth, and he or she must sign the register in the presence both of the superintendent-registrar and of the registrar of the district. But after the expiration of twelve months from the time of birth no registry thereof can be made except with the written authority of the registrar-general, and the fact of such authority having been given must be entered in the register.

(2) *As to Deaths.* A similar duty is cast upon the registrar of the district as above-mentioned with regard to deaths by the above-named Act, and it is the duty of the nearest relatives of the deceased present at the death or in attendance during the last illness—and, in default of such relatives, of any other relative in the same sub-district, and, in default of any such person present at the death, of the occupier of the house (if he knows of such death having taken place), and, in his default, of each inmate of the house, and of the person causing the body to be buried—to give to the registrar information (within five days next following the day of death), according to the best of his knowledge and belief, of such particulars as are required to be registered touching the death; and, in the case of an inquest upon the body, such information is to be conveyed to the registrar by the coroner before whom such inquest is held.

Four times in every year each district registrar is bound to deliver to his superintendent-registrar a certified copy of the entries therein, and finally the registry itself upon the book being filled; and at similar intervals the superintendent-registrar transmits the same to the registrar-general. The duties of the last-mentioned officer consist, in addition to the general supervision of the working of the whole system, in examining, arranging, and indexing the certified copies so sent. He has also to compile abstracts of their contents and send them once a year to a Principal Secretary of State, and they are afterwards laid before Parliament. The system was introduced in the year 1836.

Regma, a term, of Greek derivation, implying splitting, occasionally employed by botanists for the superior schizocarpic fruits of such plants as the Mallow, Geranium, Tropæolum, Euphorbiaceæ, and Labiatae, in which the dry syncarpous fruit breaks, when ripe, so as not to disclose its seeds,

either into its constituent carpels or into half-carpels. These segments are called *cocci*, *nutlets*, or *mericarps*, and there may be a carpophore between them or not. The regma differs from the cremocarp, such as the fruit of Umbelliferae, in being superior.

Regnard, JEAN FRANÇOIS (1655–1709), French dramatist, was born at Paris of a well-to-do family, and on the death of his father travelled in Italy, where he gambled a great deal. On returning from a second visit he was captured by corsairs and taken to Algiers, and was ransomed after some time by the consul. He subsequently travelled in other European countries, but in 1683 obtained a Government post, and settled down to a literary career. His most famous writings are his plays, two of which, *The Gambler* and *The Absent-minded Man*, are masterpieces.

Regnault, JEAN BAPTISTE (1754–1829), was born at Paris, and in childhood was taken to America by his father, and became a cabin-boy on a merchant vessel, when a French artist discovered his artistic leanings and took him to Rome. He made his studies there, and in 1775 carried off a prize at the French Academy. In 1783 he was elected a member of that body, and sent in as his diploma picture *The Education of Achilles*, which is well known by the fine engraving of Bewick. In 1795 he became professor at the Academy, and in 1813 helped to found the Academy of Fine Arts. He was made a Baron in 1819. Regnault's style is not now greatly admired.

Regnier, MATHURIN (1573–1613), French satirical poet, was a nephew of Desportes the poet, and probably derived his poetical tastes from him. His father did not approve of his verse-making, and, as he was of too violent a character to be controlled, he went to Rome in the suite of Cardinal de Joyeuse. On the death of his uncle in 1606 he inherited a little property and, though he obtained ecclesiastical orders, led a scandalous life. His knowledge of human nature is second only to Molière's among French writers. His best known productions are his brilliant satires. His works were published in 1608.

Regulus is the name applied to products obtained in the smelting of various metals, in which the ore has been treated so as to yield a richer substance—*i.e.* one containing a higher percentage of metal. This *regulus* may then be treated directly for the extraction of the metal ore, again converted into another and richer "regulus" before the final extraction is performed.

Regulus, MARCUS ATILIUS, Roman hero, was sent to Africa in 256 B.C. in command of an expedition, and conquered Tunis. He was defeated by the Carthaginians, who kept him a prisoner for several years, finally sending him to Rome to offer peace, on the understanding that he should return if unsuccessful. Owing to his strong advice, the terms of peace were refused, and he returned heroically to Carthage, where he suffered a terrible death. Some historians believe that the account

of his death was invented by the Romans to excuse their cruelty towards the Carthaginian prisoners.

Reichenbach, KARL, BARON VON (1788–1869), was born at Stuttgart, and became a doctor of philosophy. One of his first projects was to found a German settlement in the South Sea Islands, but this was nipped in the bud by his arrest and imprisonment at the order of Napoleon. He devoted himself to science, and discovered paraffin in 1831, and creosote in 1833, and became a great authority on meteoric stones. He established factories in Moravia, and made a large fortune, and was created Baron by the King of Würtemberg.

Reichenberg (Bohemian *Liberec*), a town of Bohemia, Austria, on the Neisse, 52 miles north-east of Prague. It ranks third amongst the Bohemian towns, owing its prosperity to the cloth industry, the yearly output being over a million sterling. Leather, gold and silver articles, and musical instruments are also manufactured. The town, formerly part of the estate of Wallenstein, is now owned chiefly by Count Clam Gallas, who has a fine castle here.

Reichsrath. [AUSTRIA.]

Reichstag. [GERMANY.]

Reid, CAPTAIN MAYNE (1819–83), novelist, was born in the north of Ireland, and in early life went to America to satisfy his love of adventure, and became a trapper, afterwards serving with great gallantry through the Mexican War. Settling in England, he produced a long series of excellent novels of adventure, such as *The Boy Hunter*, *The Rifle Rangers*, *The Scalp Hunters*, *The Headless Horseman*, *The War Trail*, etc. There is a monument to his memory over his grave in Kensal Green.

Reid, THOMAS (1709–96), philosopher, was born in Kincardineshire and educated at Aberdeen, where he became a professor of moral philosophy. In 1764 he succeeded Adam Smith in the chair of moral philosophy at Glasgow, and in the same year published his *Inquiry into the Human Mind*. He attacked Hume's sceptical theories, and invented the phrase "common sense." His *Essays on the Intellectual and Active Powers of Man* appeared in 1785–88. Dugald Stewart (q.v.) wrote his life, and his works have often been collected and discussed.

Reid, SIR WILLIAM, K.C.B. (1791–1858), born in Fifeshire, is chiefly known as a scientific man, though he served with distinction under Wellington, and became Governor of Bermudas, Barbadoes, and Malta successively. In 1838 he published a valuable work on *The Law of Storms*, which ran through many editions, and secured his election to the Royal Society in 1839.

Reigate, a municipal borough of Surrey, on the River Mole, 23 miles south of London, at the head of the Holmsdale Valley. Being connected with London by the services of two railway companies, Reigate is a favourite place of residence for business men, and many handsome villas are to be found in its neighbourhood.

Reindeer (*Rangifer tarandus*), the sole species

of its genus, from the northern parts of Europe, Asia, and America (where it is called the Caribou). In prehistoric times it ranged as far as Southern France, and gave its name to a period and to tribes living in that period. Down to the middle of the 13th century it lingered in Caithness. The size is about that of a red deer (q.v.), but the wild race is larger than the domestic. The general colour is a brownish-grey, and the hair becomes thicker and longer in the winter. Both sexes bear antlers, variable in



REINDEER (*Rangifer tarandus*).

shape; there is a bez tine as well as a brow tine, both either branched or palmated. In the caribou and in some English fossil forms the brow tine on one side is generally aborted so as to allow free development to that on the other. In a wild state these animals are gregarious. In summer they feed on the young shoots of willow and birch, and in winter upon lichen, to obtain which they scrape away the snow with their hoofs and antlers. The wild reindeer is shot and trapped, chiefly for its flesh and hide; and the domestic form constitutes the chief wealth of the Laplanders. It is used as a beast of draught and burden, and when dead nearly every part is utilised.

Reindeer Period, a term applied by M. Lartet in 1863 to the close of the Palæolithic age, or a period intermediate between that and the Neolithic age, when the reindeer abounded in the south of France, together with mammoth, Irish deer, cave-lion, and marmot, as evidenced by their remains in the caves of Dordogne, Périgord, Aude, and Mont Salève. Flint implements occur in these caves—less rude than those of Abbeville (St. Achenl) type, but not ground or polished—well-shaped bone-needles, and various incised drawings on bone, but no metal objects. The climate seems to have been colder and culture less than in the period of the Swiss lake-dwellings.

Relapsing Fever (FAMINE FEVER), is an infectious disease, in which an attack of high fever occurs, usually lasting about seven days; the temperature then falls, and at or about the fourteenth day of the illness a relapse takes place, the temperature again becoming raised. There is sometimes a third relapse. The disease is closely associated with starvation, and conditions of overcrowding. It has manifested itself in many parts of the globe; it is rare in this country, but has

committed considerable ravages in Ireland. A micro-organism, the *Spirillum Obermeieri*, has been detected in the blood of persons suffering from the disease. The mortality averages about 5 per cent.

Relief, in feudal law, a fine which was paid to the lord by the heir of a tenant on his death, for the privilege of succeeding to the estate.

Religion. [CHURCH OF ENGLAND, ROMAN CATHOLIC CHURCH, GREEK CHURCH, BUDDHISM, ETC.]

Remainder, CONTINGENT, in law, a remainder which is not vested.

Rembrandt, HERMAN SZOON VAN RIJN (1608-69), the great Dutch artist, was born at Leyden, and was destined by his father, who was owner of some mills, for the profession of the law; but he disliked the prospect, and studied painting under several masters, afterwards completing his artistic education by himself. In 1630 he went to Amsterdam, and there attended lectures on anatomy, which gave him a subject for his well-known picture entitled *The Lecture on Anatomy*. He married a well-to-do lady in 1634, and on her death in 1642, she left him her money on condition that, if he married again, it should go to her children. Rembrandt did marry again, and, as he was an extravagant purchaser of works of art, he became bankrupt in 1656. He is believed to have married a third time. After the year just mentioned he lived in poverty and obscurity, though working hard at his profession. He was especially great as an etcher, and produced a large number of very fine plates. Between 1628 and 1661 there were at least 400 produced by him. His mastery of light and shade is still the admiration of the art world. Nor was he much less gifted as a painter, and some of his pictures are among the finest treasures of the Dutch school. Many of his works are at Amsterdam and at The Hague, but the National Gallery in London possesses a considerable number of them, including many fine etchings, two portraits of himself by his own hand, his *Woman Taken in Adultery*, *Christ Blessing Little Children* and *The Adoration of the Shepherds*. In 1866 a fine volume of photographs of his best etchings, with notes, was published in London, and since then other splendid collections of reproductions have been issued in different cities.

Remembrancer, the name of three officials of the English Exchequer whose duties were to draw up records and processes. The Queen's (or King's) Remembrancer is the head of a department in the central office of the Supreme Court of Judicature. Some corporations, as that of the City of London, have an official with this title.

Remittent Fever. [AGUE.]

Remonstrance, in history, the Great Remonstrance, a petition against certain abuses in government presented by the House of Commons to Charles I. in 1641. In ecclesiastical history, the protest, in five written articles, of the Dutch Arminians against certain Calvinistic tenets presented in 1610 to the States-General of Holland.

Remora, any fish of the Acanthopterygian genus *Echeneis*, with several species, from temperate and tropical seas, most abundant in the Pacific and Indian Oceans. They are called Sucking-fish, from the fact that the first dorsal fin is modified so as to form an adhesive disc on the top of the head, by which they attach themselves to larger fish, turtles, and even ships. *E. remora* is found in the Mediterranean.

Remusat, JEAN PIERRE ABEL (1788-1832), Orientalist, was a member of the medical profession, who learnt Chinese in early life and was led by his studies to devote himself almost exclusively to that language. He published in 1811 a couple of treatises on the literature of China, became professor of Chinese at the Collège de France, and helped to found the Asiatic Society of Paris, of which he was president. Among his works, which are very well written, is a translation of a Chinese novel.

Renaissance, or RENASCENCE, the "new birth" or revival of learning and art in Europe in the 14th and 15th centuries, which was partly the result of the Crusades, Wycliffe's teaching, and Poggio Bracciolini's services in the study of classical Latin (1416-59), but which received a great stimulus from the influx of Byzantine scholars and manuscripts into Italy upon the fall of Constantinople (1453), from the invention of printing a few years later, and the discoveries of navigators in the last half of the 15th century. The Renaissance architecture was mainly due to the study of ancient examples by Brunelleschi of Florence (d. 1446). The Renaissance, which divides modern times from the mediæval world, was at its height between 1475 and 1525. [ANGELO, ERASMUS, HUTTEN, LEONARDO DA VINCI, BRAMANTE, JULIUS II., LEO X., MEDICI (LORENZO).]

Renan, JOSEPH ERNEST (1823-93), Orientalist and scholar, was born in Brittany, and was the son of a master-mariner who was lost at sea. He was educated by the Catholic clergy of his native place (Tréguier), and in 1836 proceeded to Paris to enter a college, his aptitude for learning being very noticeable. He studied theology closely with a view to becoming a priest, and in 1842 entered St. Sulpice to learn Hebrew and Syriac. His reading convinced him that he could no longer remain a Catholic, still less become a priest, and he left the college and took to teaching. He had even then conceived the idea of writing a life of Jesus embodying his views as to His attributes. In 1848 he obtained a premium for an essay on the Semitic languages, and this was published in an amplified form in 1855. The Academy of Inscriptions, recognising his merit, sent him on an antiquarian mission to Italy in 1849, and in 1851 he was given a post in the manuscript department of the Imperial Library. In 1852 his first book of real importance (on *Averrhoës and Averrhoism*) came out, and he became a member of the Academy of Inscriptions. His *Studies in Religious History* appeared in 1858, and in 1860 he went to Syria on a second mission for his academy.

There he wrote much of his *Vie de Jésus*, but it did not appear till 1863. It caused the most extraordinary sensation, and its author was assailed in many quarters for his opinions. Its beautiful style and mastery of language, and wonderful learning captivated most literary people. He had been appointed in 1861 professor of Hebrew in the Institute of France, but only delivered one lecture, the outcry raised leading to his suspension and transference to a post in the Imperial Library, much to his chagrin. In 1870, however, he was reappointed to the chair. His *Vie de Jésus* was the first volume of a series on the history of the Christian Church, the others being *The Apostles* (1866), *St. Paul* (1867), *Anti-Christ* (1873), *The Christian Church* (1879), and *Marcus Aurelius* (1880). In 1878 he was elected an Academician, and his other notable books are his *Abbesse Jouarre* (1886), which created some stir, *History of the People of Israel* (begun in 1887), *Judaism as a Race and as a Religion*, and some delightful *Souvenirs of Infancy and Youth*. Renan was essentially a great writer, but he was also a great thinker.

Renfrewshire, a county of Western Scotland, has the Clyde on the north, Ayr on the south and south-west, Lanark on the east, and the Firth of Clyde on the west. The county is mostly on the south of the river, but there are a few acres on the north. The length is $31\frac{1}{2}$ miles and breadth $13\frac{1}{2}$, and area 245 square miles, of which 95,000 acres are under cultivation. Along the Clyde the land is flat and fertile, the centre is undulating (with wooded knolls and picturesque scenery), and in the south-east (which belongs to the West of Scotland coal-field) and south-west the land rises to a height of 1,300 feet. Among the minerals are limestone, sandstone, granite, ironstone, which is largely worked, and there are many freestone quarries. The rivers White Cart, Black Cart, Gryffe, etc., flow through fine valleys. Manufactures and shipping are the chief industries, but there is much grazing and dairy-farming. Renfrew, Paisley, Greenock, and Port Glasgow are the principal towns. The county returns two members to Parliament, and gives his title of Baron Renfrew to the Prince of Wales, the lordship having been given by Robert III. to his son in 1404. Renfrew, the capital, is a royal and parliamentary borough, six miles north-west of Glasgow, and near the Clyde, with which it is connected by a short canal. The chief industries are iron ship-building, iron-founding, and engineering.

Rennes, once the capital of Brittany, now the capital of the French department Ille-et-Vilaine, is at the junction of the two rivers bearing those names. The Vilaine, which flows from east to west, and is crossed by three bridges, separates the High from the Low Town. The Basse-Ville lies low, and is subject to inundations, and the streets are poor and narrow; but the Haute-Ville, most of which was destroyed by fire in 1720, has wider streets and some good buildings, the principal of which are the cathedral, Palais de Justice, and the Hôtel de Ville. There is a considerable trade in butter, honey, wax, lace, cotton and linen yarns, and

among the industries are tanning, boot-, hat-, and glove-making, the manufacture of agricultural implements and of stained paper, and printing. Du Guesclin was born here.

Rennet, a preparation of the fourth stomach of a calf used in the manufacture of cheese for curdling the milk.

Rennie, JOHN (1761–1821), great engineer, was born in East Lothian, and obtained his education at schools in Prestonkirk and Dunbar. The bent of his mind turned towards mathematics and natural philosophy, and, as he was proficient in them, he was appointed temporary assistant-master at Dunbar when only seventeen. Between 1780 and 1783 he studied at Edinburgh University, and in 1784 was entrusted with the design of a bridge near that city. He became assistant to a great engineering firm, and superintended the building of the Albion Mills in London. His other early works were the Hull Docks, Kennel and Avon Canal, Rochdale Canal, and Royal Canal, Ireland. His greatest works, however, are his bridges, which include some of the finest over the Thames, such as Waterloo (1817), Southwark (1819), and London Bridges. Besides these, we owe to him the London Docks, East India Docks, Sheerness Docks, Holyhead Harbour, and the great Plymouth Breakwater, which was not completed till 1848. He became F.R.S. and contributed to the scientific journals. Rennie, who had married in 1790 an Inverness lady, left two sons, George and John (afterwards Sir John), who also became notable engineers.

Rent is an annual or other periodical return (usually money) made by a tenant to the landlord in consideration of the occupancy of lands or tenements. There are several kinds of rents; the following are some of them:—

(1) *Rent Service*, so called because it has some corporeal service incident to it as at the least fealty.

(2) *Rent Charge*, where the owner has no future interest or reversion in the land.

(3) *Fee Farm Rent*, one issuing out of an estate in fee, of at least one-quarter of the value of the land at the time of its reservation.

(4) *Quit Rents*, because thereby the tenant goes quit and free of all services.

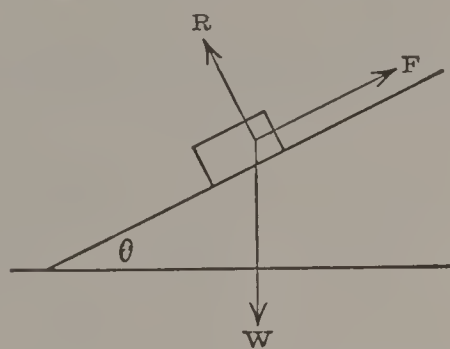
(5) *Rack Rent* is a rent of the full annual value of the land or tenement or near thereto.

Rent is not due till midnight of the day upon which it is reserved, although sunset is the time appointed by law to make a proper demand of it, to take advantage of a condition of re-entry, or to tender it, in order to avoid a forfeiture; but, more properly speaking, the demand should be made before sunset, so as to allow sufficient light to count the money, and the person making the demand must remain on the land till the sun has set. Rent is of a higher nature than ordinary debts and can be distrained for. [DISTRESS.]

Repairs are the needful works required from time to time to be done to houses or other property. Where the same is held on lease, they are usually done by the lessee under the covenant in his lease

usually known as a "repairing lease." In property let by the week or month, the necessary repairs are usually done by the landlord.

Repose, ANGLE OF. If a mass be placed upon a board and the latter be tilted up until the mass is just on the point of sliding, the angle which the



ANGLE OF REPOSE.

board makes with the horizontal is called the angle of repose. In this case there is equilibrium between the weight, w , of the mass acting vertically downward, F , the friction, acting along the board, and R , the resistance of the board, acting normally. By resolving these forces along the plane and perpendicular to it we get (1) $F = w \sin \theta$

(2) $R = w \cos \theta$. Hence $\frac{F}{R} = \tan \theta$. The ratio $\frac{F}{R}$ is the coefficient of friction; hence the angle of repose may be defined as that angle whose tangent is the coefficient of friction. It is sometimes known as the angle of friction.

Repoussé, repoussé work, relief in metal work, produced by hammering or punching from the under side of thin metal.

Representation, in law, the coming in of children of a deceased heir to take the share he would have had if he had survived; the children represent him among other heirs of the ancestor.

Reprieve, the withdrawal or suspending for a time of a sentence which has been recorded against a prisoner.

Reproduction, in plants, after nutrition the second great function of plant-life, is effected by methods that fall under two classes, *vegetative* and *sexual*. The former class includes division or separation of ordinary vegetative parts and the development of specialised but asexual reproductive structures. Such specialised reproductive structures and similar structures of a sexual character, if unicellular or minute and undifferentiated, are generally termed *spores* (q.v.), those differing in origin being distinguished by various prefixes.

The simplest case of vegetative reproduction is the *fission*, or division into two, of many unicellular plants, especially Schizophyta. This process, not accompanied by separation in the formation of the tissues of the higher (multicellular) plants, in these cases forms two individuals from one. The *gemination*, or production of lateral bud-like cells, by the yeast-plant (q.v.), is a closely related process. The natural separation of the *innovations* or branches in mosses (q.v.) by the decay of the main stem, belongs also to this class, and is precisely

analogous to artificial reproduction by *cuttings*. Mosses exhibit greater capacity for vegetative reproduction than any other group of plants, their stems, leaves, sporogonia or rhizoids being all capable of putting out protonema-threads on which bud new plants. This, and the *viviparous* production of young plants on the fronds of many ferns and on the leaves of *Begonia* and of *Bryophyllum*, are slightly higher stages, being the production of specialised structures, and leading to the *bulbils* of the onions and tiger-lilies. The *soredia* of lichens, buds containing both gonidial and hyphal cells, the *gemmae* borne in special receptacles by mosses and liverworts (q.v.), the *cloves* of bulbs, and such *tubers* on underground shoots as those of the potato, are all analogous structures.

Spores when furnished with cilia are known as *zoospores* (q.v.), and other terms such as *tetraspore*, *stylospore*, *basidiospore*, etc., are applied in particular cases, where the spores are in groups of four, on stalk-like processes, or otherwise distinguished. In most cryptogams the production of asexual spores forms a marked stage in the life-cycle, or generation in the life, of a plant, known as the *sporophyte*, which alternates with that in which sexual reproduction takes place, which is termed the *gametophyte*. [ALTERNATION OF GENERATIONS.] This sporophyte may be relatively small, as in mosses, where it consists mainly of the sporogonium, or it may be the main leaf-bearing plant, as in Pteridophyta (q.v.). In certain cases one or other of these two generations is suppressed,—the sporophyte stage in Characeæ and a few abnormal instances of what is termed *apospory* (q.v.); the gametophyte, in some Ascomycetes, all *Æcidiumycetes* and *Basidiomycetes* among fungi, and in some abnormal ferns, this being called *apogamy* (q.v.). Some fungi produce several distinct kinds of spores at different stages of their development, either on one host-plant (monœcious) or on distinct hosts (heterœcious). Such *Æcidiumycetes* as *Puccinia* are examples of this polymorphism. [MILDEW.] In the highest Pteridophyta two kinds of spores are asexually produced: *microspores*, which are small and bear the male sexual cells, and *megaspores*, which are larger and bear the female structures. In flowering plants there is a similar *heterospory*, the microspore being known as the *pollen-grain* and the megaspore as the *embryo-sac*. In such cases the gametophyte has been reduced to mere appendages of the sporophyte.

The cell or organ which gives rise to spores is termed a *sporangium*; and, if it is borne on a leaf, such leaf is called a *sporophyll*. Flowering plants are so called from bearing clustered groups of such sporophylls, those bearing microsporangia being known as *stamens*, and those bearing megasporangia as *carpels*, whilst other leaves, performing such subsidiary functions as protection and insect-attraction, known as *sepals* and *petals*, are also generally part of the *flower*.

Sexual reproduction, absent in the lowest plants and in cases of apogamy, consists essentially in the union of two special cells or *gametes*, which are

called *planogametes* when ciliated, *aplanogametes* when not. It is now tolerably certain that these sexual cells have been evolved from asexual reproductive cells and the organs containing them from asexual sporangia. The simplest case of sexual reproduction is that known as *conjugation*, as in *Mucor* or *Mesocarpus*, in which the uniting gametes are alike. In higher stages the female gamete *oosphere*, *ovum*, or *germ-cell*, is larger than the male, or *sperm-cell*, and their union is called *fertilisation* (q.v.), its product being an *oospore*, whilst in conjugation it is called a *zygospore*. The organ enclosing the germ-cell is styled an *oogonium* in the lower plants where it is unicellular, and an *archegonium* in the higher classes where it is multicellular; but within the megaspores (embryosacs) of Angiosperms the archegonium is much reduced and no longer surrounds the germ-cell. Similarly the organ producing the (generally more numerous) sperm-cells is called an *antheridium*; but, whilst among cryptogams it generally gives rise to ciliated *antherozoids*, in flowering plants it is represented merely by the *pollen-tube* with its contained *reproductive nucleus*.

The product of fertilisation varies considerably, from the unicellular zygospore of *Mucor*, to the *cystocarp* enclosing numerous *carpospores* in the higher algæ, the complex fructifications of the Ascomycetes, and the seed and fruit investing the embryo in Angiosperms. In these latter cases the effect of the sexual process extends to surrounding structures, producing, for instance, the change of the female sporophylls or carpels into a fruit. Whilst as a rule the asexually-produced spore becomes free and so disperses the species, in Phanerogams only the male microspore does so, the megaspore remaining enclosed within its megasporangium, the *tercine*, which, invested with other integuments, is detached as the seed (q.v.), the most distinctive structure of the sub-kingdom. [FERTILISATION, POLLINATION, SEX, ETC.]

Reptanta, a group of mollusca belonging to the suborder Azygobranchia characterised by the possession of a creeping disc-like foot. It includes three divisions: (1) *Holochlamyda*, including the Top-shells (*Trochus*) and the common pond-snail (*Paludina*); (2) *Pneumono-chlamyda*, which are terrestrial and breathe by a lung sac, e.g. *Cyclostoma*; (3) *Siphono-chlamyda*, which are all marine, including the Whelk (*Buccinum*), the Cone-shells (*Conus*), the Cowry (*Cypræa*), etc.

Reptiles, a class of Vertebrate Animals, below the Birds and above the Amphibians, but with affinities to both. The body is covered with horny scales or bony plates or shields; the temperature of the body does not greatly exceed that of the medium in which the animals live; the heart in most is three-chambered, only the alligators and crocodiles having two ventricles. Respiration is carried on by lungs, never by gills. The skull articulates with the atlas vertebra by means of a single condyle, and the jawbone with the skull by means of the quadrate bone. Most of the class lay eggs, but in some—the viper, for example—the eggs are hatched within the body of the mother. There

are five living orders: (1) Chelonia, (2) Rhynchocephalia, (3) Lacertilia, (4) Ophidia, and (5) Crocodilia, for which see respectively TORTOISES, SPHENODON, LIZARDS, SNAKES, and ALLIGATORS and CROCODILES.

Republic, a commonwealth in which the head or heads of the executive are chosen by an electorate or indirectly by elected delegates or representatives. The electorate may range from a narrow oligarchy to a pure democracy in which every adult has the franchise. The chief republics have been those of Athens, Rome, Venice, the United States of America, and France.

Republican, one who lives under, or is in favour of, that form of constitution which is called a republic. In the United States the term has become attached to the political party, formed 1856 (?), which was opposed to the maintenance of slavery and which rose into power in 1861, and was the main element in resisting the secession of the Southern States; while the Democrats, as a "State-rights" party, to some extent sympathised with the South. The Republicans remained in power until 1885, and won it again in 1889, under President Harrison, but lost it again in 1893. Their platform comprises a certain degree of centralisation, thorough Protection by a high tariff, and lavish expenditure of public money. [DEMOCRAT.]

Requiem, a mass for the dead. In music it generally contains the Requiem proper, the Kyrie, Dies iræ, Domine Jesu Christe, Sanctus, Benedictus, Agnus Dei, and Lux Æterna.

Reredos, a decorated screen behind an altar, or, when the altar stands against the wall, a mural decoration above and beside the altar. Originally the term meant the back of a fireplace.

Reserves, those military forces of a state which are only called upon in times of special danger or weakness. They consist in the main of soldiers and sailors who have served their time in the regular forces.

Resins are a class of substances which are of vegetable origin, being usually obtained (1) as exudations from the bark or incisions of certain trees, (2) by extraction from plants by means of alcohol or other solvent, or (3) as solidified masses or fossil resins in certain geological formations, e.g. the coal measures. They are usually translucent, yellowish, amorphous bodies, with a peculiar odour. They are insoluble in water, but soluble in many organic liquids, e.g. benzine, turpentine. They melt if heated, and are combustible, giving a smoky and luminous flame. In composition they appear to consist chiefly of a mixture of different acids closely allied to bodies of the *terpene* class, and probably derived from them by oxidation. They verge into the balsams and the soft oleo-resins, there being no essential or fixed difference. Many are used for the preparation of varnishes, as *copal*, *dammar*, etc. Others find application in medicine, e.g. *guaiacum*, *copaiba*, etc., while others are put to varied uses in the arts, as ordinary pine-resin,

colophony, amber, frankincense, Canada-balsam, benzoin, etc. [BALSAMS.]

Resistance, in electricity, is that property of a conductor in consequence of which energy must be expended and converted into heat in order that a current may be maintained in that conductor. It is seen from Ohm's law (q.v.) that this resistance is equal to the ratio of the electromotive force to the current strength, and it follows that it is constant for any conductor, provided the conditions are similar, irrespective of the strength of the current. The dimensions of resistance are LT^{-1} , the same as those of velocity, so that the unit of resistance in the absolute electromagnetic system is a velocity of one centimetre per second. The practical unit, the ohm, is $10\cdot9$ times this, and the concrete standard ohm, with which other resistances may be compared, is defined by the Board of Trade as "the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice $14\cdot4521$ grammes in mass of a constant sectional area, and of a length of $106\cdot3$ centimetres." The resistance of a conductor of given material is directly proportional to its length and inversely proportional to its sectional area; the resistances of conductors of similar shape but different materials vary widely. That of most conductors increases with rise of temperature, but the reverse is the case with carbon and electrolytes. It has been found in the case of most pure metals, with the exception of iron and mercury, that the resistance at any temperature $t^\circ\text{C.}$ is equal to $r(1 + 0\cdot003824t + 0\cdot0000126t^2)$, where r is the resistance at 0°C. This formula is true between the limits 0° to 100°C. Recent observations of Dewar and Fleming on the resistance of metals at very low temperatures indicate that at the absolute zero (-273°C.) metals would be perfectly good conductors and have no resistance at all. In the case of certain alloys, such as German silver, platinum silver, manganin, and others, the variation of resistance with temperature is very small. These alloys are therefore used for the construction of coils of wire, having certain definite resistances and known as *resistance coils*, which are used for measuring and comparing the resistances of other conductors. A number of coils connected in series having the junctions joined to brass blocks, and being put in a suitable case, constitute a *resistance box*. By inserting conical brass plugs between the brass blocks (where grooves are made to fit the plugs) any of the coils may be short-circuited, and the total resistance will be the sum of the resistances of those coils which are unplugged. [WHEATSTONE BRIDGE.] The resistance of a conductor may be measured in various ways: (1) By observing the deflection of the needle of any galvanometer in circuit with an unknown resistance and a constant battery, and then producing the same deflection by substituting an adjustable resistance whose value is known; the resistance of the conductor will equal that of the known resistance. (2) By measuring the current produced in a conductor by a known difference of

potential; the resistance of the conductor in ohms will be equal to the potential difference in volts divided by the current in amperes. (3) By Wheatstone's Bridge or Balance (q.v.), and by numerous modifications of these methods.

Resolution of Forces is the undoing of what is done when we compound two forces into one. [PARALLELOGRAM OF FORCES.] Let AC be a force, and draw *any* parallelogram, $ABDC$, having BC as a diagonal, then BC is equivalent to two forces, BD and BA , or BC can be resolved into those two forces, the directions of which may be chosen B at will. It is very often extremely convenient to

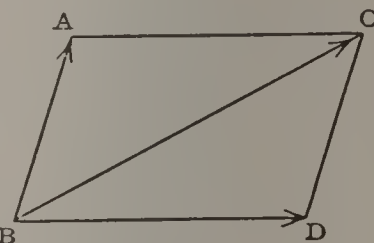


Fig. 1.

resolve a force into two components at right angles to each other. Let ABD be a right angle, and $CBD = \alpha$; then BD and BA are the components as before, but $BD = BC \cos \alpha$, and $BA = BC \sin \alpha$. Although a force may be resolved into two others in an infinite number of ways, practically, when the direction of the one is chosen, the other is always taken at right angles to it. When dealing with forces in space, it is usual to resolve them in three directions at right-angles to each other.

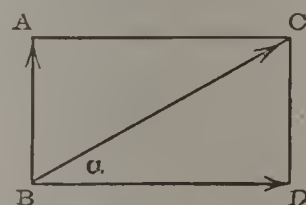
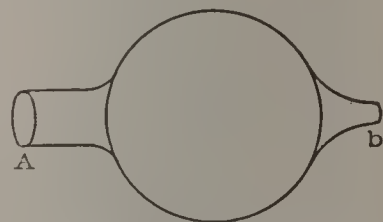


Fig. 2.

Resonators are instruments for reinforcing any particular sound. A jar containing air will emit a certain note if the air within it is set in vibration, and this note depends simply on the size of the jar. Suppose a tuning-fork giving out the same note is brought near to it, the air in the jar will be set in motion and will vibrate synchronously. The sound is therefore reinforced, and the jar acts the part of a resonator. If, however, the vibrations of the tuning-fork do not synchronise with those of the jar, the latter does not begin to sound, and so no reinforcement takes place. If a composite sound occur near a resonator, the latter will begin to sound, provided one of the notes of the composite sound synchronises with it. Hence that one note is picked out and rendered more powerful than the others. Helmholtz used this principle in studying complex sounds. His resonators were globes of air with a small orifice, B , which could be placed in the ear. A large opening, A , received the sound-waves. By means of a number of these spheres capable of giving out different notes he was able to resolve any sound into its simple components.



HELMHOLTZ'S RESONATOR.

Resorcin, or RESORCINOL, consists chemically of dioxybenzene, $C_6H_4(OH)_2$. It hence has the same composition as hydroquinone (q.v.), from

which it, however, differs in the positions of the hydroxyl groups with regard to the benzene ring. [BENZENE.] It may be obtained from a number of resinous substances and from Brazil wood, but it is now almost entirely prepared synthetically from artificial products. It forms crystals of the Rhombic system, which melt at 180° , and is soluble in water and most organic solvents. It may be recognised by a dark violet coloration, which is given it by a solution of ferric chloride. It is very largely used in the production of dyes, many brilliant colours being obtained from compounds derived from resorcinol, *e.g.* the well-known *fluorescein eosin* and allied compounds.

Respiration, the taking in of oxygen and giving out of carbon dioxide, which is an essential function of all living protoplasm, though especially connected with its katabolism (q.v.). In anaërobiotic plants, such as some of the schizophytic ferments, the oxygen can be obtained from its compounds; but all aërobiotic plants—that is, the vast majority of the Vegetable kingdom—obtain it free from the atmosphere. As there are degrees of respiratory activity among animals, so the respiration of plants more nearly resembles that of torpid or cold-blooded animals, far smaller volumes of gas being involved in the process than in assimilation—that is, the action of chlorophyll. This has given rise to the mistaken statement that vegetable respiration is the converse of that of animals, by which is only meant that the total effect upon the atmosphere of green plants when in sunlight is the converse of that of animals. Respiration does not cease in the dark, nor is it in any way dependent upon chlorophyll, so that its effects are well seen in such cases as fermentation by yeast, or germinating seeds, where no chlorophyll is present. The cuticle is permeable to gases; but there are no special organs of respiration among plants.

Respiration, in ANIMALS. In the article on the LUNGS the structure of those organs has been described, and it has been seen how the ultimate air passages consist of a membrane supporting a network of capillary blood-vessels, and lined with flattened epithelial cells. The way in which the blood, in its passage through the lungs, is thus brought into intimate relation with the air in the pulmonary alveoli, in such a way as to facilitate the interchange of gases between blood and air, has thus been made manifest. Under the present heading it will be necessary to allude to the mechanism by which the movements of inspiration and expiration are effected, to the changes which are brought about in the chemical constitution of air by respiration, to the changes simultaneously brought about in the blood, to the influence of the nervous system on respiration, and to certain other topics.

Mechanism of the Respiratory Movements. The act of inspiration consists in an increase in the capacity of the chest, brought about mainly by the contraction of the diaphragm (the descent of which muscle increases the vertical diameter of the chest), and also in part by the raising of the ribs (which are, speaking generally, attached obliquely between the spine and the sternum) in such a way that their

elevation increases the lateral and antero-posterior diameters of the chest. The raising of the ribs produces a thrusting forwards of the sternum, while at the same time each rib rotates about an axis drawn from the head of the rib behind to the sternum in front, an increase in the lateral diameter of the chest resulting from such movement, which has been compared to that produced in raising the handle of a bucket. The angle between the costal cartilage and the bony part of the rib is, moreover, somewhat opened out when the rib is raised, thus effecting a slight additional increase in the antero-posterior diameter of the chest. The chief muscle of ordinary inspiration, then, is the diaphragm, the most important auxiliary muscles being the external intercostals, which are concerned in raising the ribs. In forced inspiration a number of other muscles are brought into play (scalene muscles, sterno-mastoid, pectorals, etc.). It has already been explained [LUNGS] how the external surface of the lung follows the movements of the chest wall, the atmospheric pressure causing distension of the elastic lung tissue. When the various muscles concerned in increasing the capacity of the thorax cease to act, the elastic force of the distended lung comes into play, and it will thus be readily understood that expiration is in the main a recoil from the state of tension produced by inspiration, and that little or no muscular power is required to bring about the change from enlargement to diminution of the thoracic capacity in ordinary breathing. In forced expiratory movement, however, certain muscles are brought into action; the abdominal muscles which contract and press the viscera contained in the abdomen upwards against the diaphragm, and muscles which depress the ribs assist them in bringing about lessened capacity of the chest.

The quantity of air drawn in or expelled in ordinary inspiration or expiration amounts to about 30 cubic inches (*tidal air*). The amount in excess of this which can be inhaled by the deepest possible inspiration is termed *complemental air*. In expiration, after the expulsion of the tidal air, a further quantity of air can be breathed out by forced expiration (*reserve air*). The air remaining in the chest after the deepest possible expiration is termed the *residual air*, and its amount in an adult of average development has been estimated at about 100 cubic inches.

The *respiratory capacity* is tested by an instrument called a *spirometer*, which is adapted to indicate the amount of air which can be expelled by forced expiration after a deep inspiration has been made. In an adult man of average height the respiratory capacity is about 225 cubic inches. The respiratory movements are repeated in the adult about 18 times a minute, and in health they bear a tolerably constant proportion to the pulse-rate, some four or five pulse-beats occurring in correspondence with each respiratory cycle.

Changes brought about in the Air and in the Blood by Respiration. The expired air differs from the inspired air in the following respects:—Its temperature is somewhat increased, it contains about $4\frac{1}{2}$ per cent. less oxygen, and the carbonic acid is

increased to very nearly the same extent that the oxygen is diminished. It has been estimated that an average man gives off about $\frac{1}{10}$ of a cubic foot of carbonic acid in the course of an hour. The expired air contains, moreover, an increased quantity of watery vapour, and a very small amount of free ammonia and organic matter. In correspondence with these changes produced in the air by respiration, the blood in the capillaries of the lungs gains oxygen and loses carbonic acid, being changed from dark venous to bright arterial blood. It also becomes slightly cooler and somewhat more readily coagulable. As to the way in which the interchange of gases between the blood and the air in the pulmonary alveoli is brought about, it may be remarked that the ordinary diffusion of gases plays some part in the matter. As regards the taking up of oxygen, however, the affinity of the hæmoglobin of the blood for that gas is an important factor in determining its absorption. There appears to be reason, moreover, for supposing that the epithelial cells, which line the walls of the ultimate air-spaces of the lung, exercise some secretory action, and so modify the ordinary physical laws of diffusion of gases.

Influence of the Nervous System on Respiration. Respiration is an involuntary act, although it can, to some extent, be modified by the influence of the will. It has been found that the nerve-centre which regulates the movements of respiration is situated in the medulla oblongata, close to the point at which the pneumo-gastric nerves originate. The action of this nerve-centre is modified by impressions, transmitted to it from the peripheral terminations of the pneumo-gastric nerves, which travel along those nerves to the centre. It is also modified by the condition of the blood circulating in the medulla. The impulses determining the ordinary respiratory movements are transmitted from the medulla along the phrenic nerves to the diaphragm, and along the intercostal nerves to the intercostal muscles.

It remains only to allude to *dyspnœa*, the condition of difficult breathing brought about when there is interference with the due aëration of the blood. This may result from diseased conditions in the lung, or mechanical interference with the respiratory movements, or failure of adequate supply of oxygen. The blood in any of these events is imperfectly aërated, and such blood circulating in the medulla stimulates the respiratory centre to unwonted activity, and the forced respiratory movements of dyspnœa occur. [APNŒA.] If the cause of the difficulty is not removed, the dyspnœa passes into what is known as asphyxia (q.v.).

Respiratory Trees are two or more outgrowths from the intestine of many Sea-cucumbers (Holothurians) which perform the function of respiration. They occur in all Holothurians except the deep-sea group of Elaspoda and the Apneumona.

Resurrection, a word generally used with reference to the Christian theological belief of a reunion of the body and soul in a future state of

existence. The many physical difficulties as to the reuniting of the material particles of our present bodies are to some extent obviated by the explanation given by St. Paul, and by his theory of a spiritual body, which he compares to the analogy of a sown grain of corn and that which grows from it. The resurrection of Christ is one of the main grounds upon which a belief in the resurrection of the body is based. A belief in the immortality of the soul, with or without the belief in a continued identity of body, is widely spread through all times and among most races, from the belief of the Australian native that he will come back to earth a white man, or the Oriental doctrine of transmigration and progress of the soul, to the belief of spiritualised materialism that the principle of life is indestructible, though personal identity will be lost.

Reticularia, a synonym for Foraminifera (q.v.).

Retina. [EYE.]

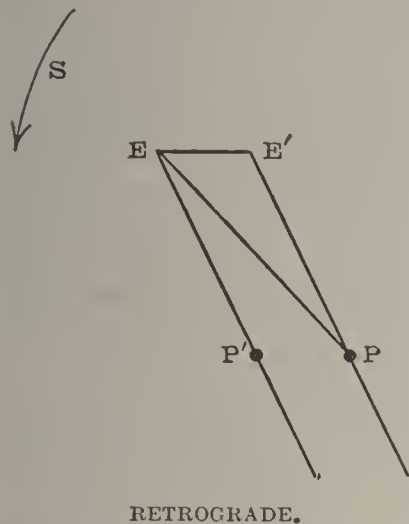
Retinitis. Inflammation of the retina is met with in the subjects of Bright's disease (albuminuric retinitis), in diabetes, and in syphilis. Pigmentary retinitis is a remarkable disease affecting the retina and choroid, which, when it appears, usually manifests itself in several members of the same family. All these conditions are detected by the use of the ophthalmoscope. In detachment of the retina that membrane becomes separated from the choroid coat by the effusion of fluid between the two; it is met with in conditions of extreme myopia.

Retirement, in the Navy and Army, is the withdrawal from service of commissioned officers with the retention of more or less of their pay. Retirement may be either voluntary after the completion of a certain number of years' service, or compulsory at a later date, the period being fixed from time to time by Royal Warrant or other authority. In the Army voluntary retirement is possible after 12 years' service for officers below the rank of Major-General, and is compulsory at ages fixed according to rank. In the Navy Admirals and Vice-Admirals must retire at 65, Rear-Admirals at 60, Captains at 55, Commanders at 50, and Lieutenants at 45, and they may retire at option five years earlier respectively.

Retriever, a sporting dog trained to find and bring back killed and wounded game. There are two breeds, and of both the Newfoundland seems to have been the origin. Crosses with the setter gave rise to the wavy-coated form, while the curly-coated retriever was produced by an infusion of poodle, or water-spaniel blood. These dogs are marked by great intelligence, and are generally good-tempered. They are also excellent watchdogs. Other breeds, notably terriers, have been trained to retrieve.

Retrograde. The planets appear to move in an extremely irregular way among the fixed stars. Sometimes their motion is in the same direction as that of the sun, in which case it is said to be *direct*, while at other times it moves in the opposite direction and is said to be *retrograde*. These irregularities are due to the fact that the earth is moving, but

to the observer it seems as though all the motion is due to the planet. Imagine a planet, P, to be viewed from the earth, E, and to remain at rest



while the earth moves a short distance, E E'. It will then appear the same as though the observer were still at E, but the planet had moved to P', the line E P' being parallel to E' P. The direction of motion of the planet will therefore appear to be the same as that of the hands of the clock, but the sun appears to move contra-clockwise among the stars; hence the planet in this case

has a retrograde motion. The planet, however, does not remain at rest, and so the final result depends on the sum of the effects produced by the motion of both earth and planet.

Retz, JEAN FRANÇOIS PAUL DE GONDI, CARDINAL DE (1614-79), was born at Montmirail, and was the nephew of an Archbishop of Paris and son of a French officer. He was partly educated by the famous Vincent de Paul, and in his early years had some reputation as a gallant and duellist. His ambition, however, was great, and he cleverly ingratiated himself into the favour of Louis XIII., and was made coadjutor to his uncle, whom he succeeded. His intrigues against Mazarin made him popular in Paris, and he took a leading part in the civil war known as the Fronde. The Pope made him a cardinal in 1651, but in 1652 his intriguing became too dangerous, and he was arrested and imprisoned, but managed to make his escape, and after Mazarin's death (1661) he was allowed to return. He lived in retirement and wrote his valuable *Memoirs* during his later years.

Reuchlin, JOHANN (1455-1521), scholar and reformer, was born of poor parents at Pforzheim, and was sent to Paris in youth, and there received an excellent education. In 1474 he was teaching Greek and Latin himself at Basle. He studied law and, being admitted, practised at Tübingen, where he married. He made the acquaintance of many notable people, and received a legal appointment at Stuttgart, which gave him the leisure to study Hebrew, of which he became a master. There was a project for the destruction of all Jewish anti-Christian books, and Reuchlin pronounced strongly against it. A fierce discussion arose, and he was attacked by the Dominicans, but the Pope sided with him, and he gained the day. This controversy distinctly heralded the Reformation. Reuchlin wrote some learned works in the Hebrew language.

Réunion—called before the Revolution ÎLE DE BOURBON—is an island belonging to France, in the Indian Ocean, 115 miles W. of Mauritius, and 350 miles E. of Madagascar. It is 38 miles long, 28 broad, and contains 970 square miles. A volcanic

range of mountains runs through the island, the highest points being the Piton de Fournaise (8,612 ft.) in the south-east, still an active volcano, and the Piton de Neige (10,000 ft.) in the centre. From this range, the land descends in plateaus and terraces, interspersed with deep glens and gorges, presenting some fine scenery. The soil is fruitful and watered by many streams. The climate is hot, but wholesome.

Reuss, the name of two principalities of Central Germany ruled by different lines of the same family. All the males of each line are called Henry, and are distinguished by numbers, a fresh series starting with each fresh hundred in the elder and each century in the younger branch. It consists of (1) Reuss-Greiz (ruled by the elder line), of 148 square miles, on the left bank of the Saale and traversed by the Elster, and (2) Reuss-Schleiz with Reuss-Lobenstein-Ebersdorf, containing 297 square miles. The former of these is largely pasture-land, rearing much horned cattle and sheep, and producing potatoes, flax, and some hops, while the chief manufactures are woollen, linen, and cotton-weaving. The latter is well-wooded and fertile, and produces much grain. Iron is worked, and there is much quarrying of roofing-slates. The population of both is mostly Protestant.

Reuter, FRITZ (1810-74), German humorist, was the son of a burgomaster, and studied at Rustock and Jena Universities, joining one of the numerous student societies then in existence. When these were proclaimed by Metternich in 1833 he was arrested and sentenced to 30 years' imprisonment, of which term he actually served seven. On his release he took to farming, and then taught gymnastics. He published his first volume of humorous poems in 1853; they were written in Low German dialect, and became very popular. A second speedily followed, and his enormous success placed him in the front rank of the humorists of this century. In 1859 the first of his *Old Camomile* series of tales, which are among his best productions, appeared, and in 1862 *My Prison Life*. In 1863 he settled at Eisenach, and died there in 1874, in which year his *Life* appeared.

Revel, a Russian seaport, capital of Esthonia, is situated on a small bay in the Gulf of Finland, 200 miles S.W. of St. Petersburg. It was strongly fortified, and part of the fortification remains. The Governor's residence, public offices and courts, the cathedral, the church of St. Olaus, and other Roman Catholic, Greek, and Protestant churches, are the chief buildings. The harbour, though difficult to enter, is deep and admits ships of war, and does an important trade. The principal exports are hemp, flax, timber, corn, spirits, and goat-hair, and there is a large import trade. It is resorted to for sea-bathing.

Revelation, BOOK OF, also called the APOCALYPSE, is the last book of the Bible, and is generally accepted as embodying visions seen by St. John the Divine during his banishment at the Isle of Patmos towards the end of the 1st century. It was generally accepted as genuine by the early Christians, and has been the cause of countless theories and

methods of interpretation; some commentators considering it to be a contemporary history of the Church, others the allegorical history of a period finished at the time of its composition, and others a history of what shall be hereafter.

Revenue, that which comes in through the possession of property, is generally taken to cover national income from whatever source derived. Thus in the United Kingdom the sources of revenue are Taxes and other duties, Customs, Excise, Post Office, Telegraphs, Stamps, Crown-lands, Mint, and miscellaneous sources, amounting in the aggregate to close upon one hundred millions.

Reverberatory Furnace, a class of furnaces largely employed in the smelting of various metals—*e.g.* lead, copper, tin, etc. They differ in details according to the special purpose for which they are intended, but all are made with low arched roofs, which deflect the flames and products of combustion of the burning fuel down upon the surface of the ores, etc., which are being treated. These are therefore heated directly by the furnace flames, and, owing to the presence of reducing gases, as CO, etc., in the combustion products, are partially or wholly reduced to the metallic state.

Revere, PAUL (1735–1818), American patriot and engraver, was of Hnguenot family and born at Boston, Massachusetts. His father, a goldsmith, taught him his art, and he won a reputation for his engravings on plate. He was strongly opposed to the British connection, and issued clever prints, engraved by himself, against it. He took a prominent part in the war, and afterwards returned to business, making a large fortune by his mechanical inventions and artistic work.

Reversion, the estate which reverts or returns to a grantor after the grant of a particular estate or interest in the property. This reversion is founded on the principle that where a person has not parted with his whole estate or interest in the land, all that which he has not parted with remains in him, and the possession of the land reverts or returns to him upon the determination of the preceding estate—*i.e.* the estate which remains after the grant. In other words, it is “the residue of the estate left in the grantor.”

Revivalist, one who takes part in revivalism, which is a kind of awakening and stirring of religious feeling. Many such movements have taken place, among them being the Reformation, the movement set on foot by Wesley, Whitefield, and others; but the name is usually applied to those who took part in the movement initiated in the United States of America in 1858, and which spread to Scotland and Ireland, and to some extent to England. Among noted revivalists were Messrs. Moody and Sankey, who visited England in 1873.

Revolver, a repeating fire-arm, now generally a pistol, possessing a single barrel, and a cylinder holding five or more cartridges. By means of mechanism connected with the lock this cylinder revolves, bringing the charged chambers successively into line with the barrel. In an earlier form the

barrel, which was four-fold, used to revolve, and so bring each aperture beneath the hammer. An American, named Colt, made such improvements in the mechanism as brought the instrument into general use, and since the introduction of the system of breech-loading and the employment of metal cartridges the weapon has been greatly improved and modified. Among the improvements may be mentioned self-cocking, automatic ejection of spent cartridges, and safety-bolts to prevent accidental discharge. Deane and Adams, Smith and Wesson, and Webley are the chief modern revolver-makers. The principle has also been extended to some types of quick-firing guns. The principle itself is of some antiquity.

Reward, a compensation or return for something done. It has a legal significance, for, by a statute passed in George IV.'s reign, in order to encourage the apprehension of offenders in certain cases (and in substitution of previous enactments) it is provided that when a person shall appear to have been active in or towards the apprehension of anyone charged with murder, or with a felonious and malicious shooting or attempting to shoot, stabbing, cutting, or poisoning, or administering anything to procure miscarriage, or with rape, burglary, or felonious house-breaking, bullock-stealing or sheep-stealing, or with being accessory before the fact to any of such offences or to receiving any stolen property, a reasonable compensation shall be awarded him for his expense, exertion, and loss of time, and in case a man be killed in such attempt the court may order compensation to his wife or relatives.

Reybaud, MARIE-ROCH-LOUIS (1799–1879), French economist, was born in Marseilles, and, having made a moderate fortune, devoted himself to literature, producing some humorous novels and also some admirable social studies. His best-known and cleverest works are *Jerome Paturot in Search of a Social Position* (1843), *Studies on the Modern Reformers or Socialists* (1840–43), and *Jerome Paturot in Search of the Best Republic* (1848).

Reynard the Fox is an epic fable of northern origin, in which animals figure, with the fox as hero. Grimm tells us that all the Aryan races have beast fables, in which connection may be mentioned the cobra stories of Miss Bartle Frere's *Old Deccan Days* and *Brer Rabbit* of the negroes. The Franks introduced *Reynard* into France, where it somewhat changed its nature and became a satire partly social, partly political. A Low German version appeared at Gouda in 1479, and was translated by Caxton in 1481, and in 1498 Backhuisen, of Rostock, published a poetic version in Low German called *Reynke de Vos*, founded upon an old Dutch prose version, and relating the adventures of Reynard at the Lion's Court, where his wit and resource carried the day. The fable is also found in Danish, Swedish, and other languages.

Reynolds, SIR JOSHUA (1723–92), painter, was the son of a Devonshire rector, and was educated at Plympton, his native place. His taste for drawing led his father to send him to London in

1741 to study under Hudson, then a prominent portrait-painter. He stayed with the latter three years, and then practised the profession on his own account in London and elsewhere. His first noteworthy work was a portrait of Keppel, who gave him a passage to the Mediterranean. He visited all the principal Italian cities, and saw all the great works of art, finally returning, after a short stay in Paris, in 1752, after an absence of several years. Whilst in Italy he lost his hearing, and this infirmity has been often alluded to by his contemporaries. He settled in St. Martin's Lane, and began to paint portraits, securing gradually most of the fashion and beauty and intellect of the day among his clients, and his prices rose from ten guineas to hundreds for a portrait. In 1761 he went to reside in Leicester Square, and his house became the resort of all the most important men of the day. He numbered among his warmest friends Burke, Goldsmith, Garrick, and Johnson, and founded the well-known "Literary Club" with their aid. On the starting of the Royal Academy in 1768, he was made its president and was knighted. He never married, and on his death left a fortune of £80,000 to a niece. He was buried in St. Paul's Cathedral. Reynolds, though unquestionably one of the first of English painters, was often careless in his work, and some of his colour has faded; but his portraits are so valuable a possession that his name is probably more honoured than those of many greater artists. As a writer on art he also obtained a good reputation, his *Fifteen Discourses on Art* being still held in high estimation. The National Gallery possesses many fine portraits by him.

Rhabdocœlida, an order of the group of worms known as the Turbellaria (q.v.) or Planarians, and including those members of this group which are small in size with generally a straight, unbranched intestine. The sub-class was originally founded on the latter character, but it is now found necessary to include one group with a lobed intestine in this division. It is divided into three sub-orders:—(1) the Acœla, including some primitive marine forms without any intestine; (2) the Rhabdocœla, including the typical members with a straight intestine; and (3) Alloicœla, with a lobed intestine. The second order is that of the Dendrocœlida.

Rhabdoliths are the minute, somewhat umbrella-shaped, calcareous spicules which are very abundant in deep-sea deposits both of the present day and of the past, whether true fossil oozes or chalk. They are formed by organisms known as "Rhabdospheres," which are generally regarded as calcareous algæ.

Rhabdophora, or ROD-BEARERS, a term applied to the class of Graptolites (q.v.).

Rhabdopleura is one of the two genera of animals allied to the "Moss Animals" or Bryozoa, which form the group Pterobranchia (q.v.). The members of the genus are marine, and occur in somewhat deep water off the coast of Norway and the Shetlands and North Ireland.

Rhætic Beds, the name given to the uppermost division of the Trias (q.v.) from its development in the Rhætic Alps, where it forms a massive group of marine limestones and dolomite, with bands of shale. In Germany they are represented by sandy clays, sandstones, and thin seams of coal, containing ferns, horse-tails (*Equisetites*), and cycads (*Pterophyllum* and *Zamites*), in addition to the typical marine pelecypods, *Aricula contorta*, *Cardium rhæticum*, *Pecten valoniensis*, and *Pul-lastra arenicola*, the crustacean *Estheria*, fish, such as *Ceratodus*, saurians, and the oldest European mammal, *Microlestes antiquus*. In England these beds form a narrow band from Lyme Regis to the Yorkshire coast and Carlisle, with an average thickness not exceeding 50 feet, though sometimes 150 feet, and consisting of thin beds of *black paper-shales* with *Aricula contorta*, white limestone (White Lias), a bone-bed containing pyrites, fish-bones, coprolites, etc., and grey marls and clays. From their exposure near Cardiff, as also on other Severn cliffs, they are also known as *Penarth beds*.

Rhæto Romance. [ROMANSCH.]

Rhampsinitus, one of the ancient Egyptian kings, whom Diodorus calls Rhampsis. He was the successor of Proteus and the predecessor of Cheops. A number of legends are extant about him. He is said to have possessed wonderful treasures, which he was obliged to keep in a repository of stone for safety. He descended into Hades and there played dice with Demeter, the goddess, and on his return inaugurated a festival in her honour. He belonged to the 20th dynasty, and built the western propylæa of the temple of Hephæstus, in front of which were placed two great statues called by the Egyptians *Summer* and *Winter*.

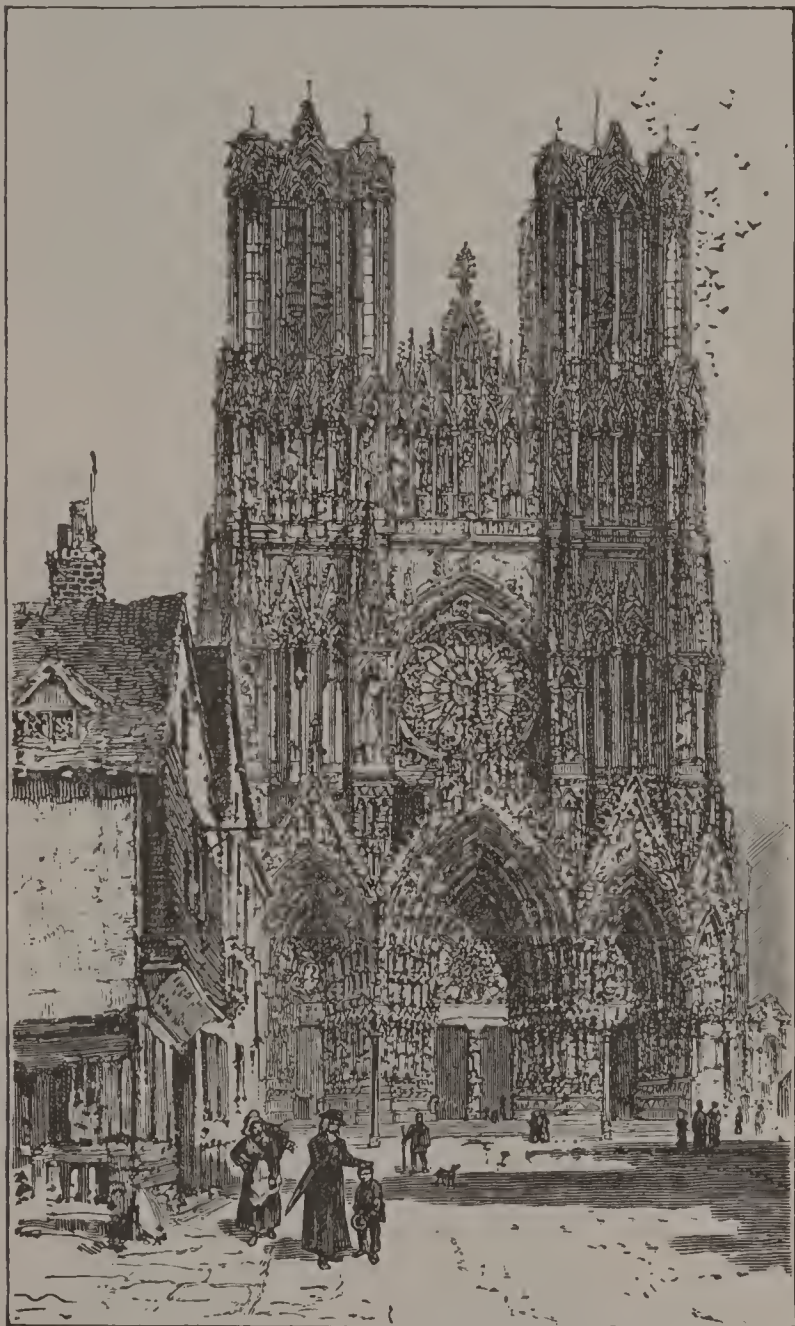
Rhatany, the root of *Krameria triandra*, an undershrub belonging to the order Polygalaceæ, the Milkwort family, and native to Peru. The roots are astringent, and yield a red infusion which is used as an adulterant of port wine.

Rhea, a mythological divinity of the ancients, mother of Zeus, Poseidon, and other gods by Cronos, who is said to have swallowed them all except the first-named. She was worshipped as the "great mother," "mother of the gods," etc., by the Thracians, Phrygians, and other nations, and is said to have been born at Thebes, but few definite traditions are now discoverable about her.

Rhea, a genus of South American ostrich-like birds with three species, each distinguished by its geographical range as well as by anatomical characters. The wings are useless for flight, though more developed than in the ostrich. Each of three digits of the fore-limb bears a claw. There are three toes. The feathers have no aftershaft; and the general plumage is sombre, except in Darwin's Rhea, from the south-east of the continent, most of the feathers of which are tipped with white.

Rheims, a French town in the department of Marne, is on the right bank of the Vesle, and on the Aisne and Marne Canal. Vine-clad slopes surround the valley in which it lies. The town is strongly

fortified by outlying forts, the streets are regular and wide, and there are fine squares. The chief buildings are a magnificent 13th-century cathedral, 466 ft. long and 121 ft. high, with two large towers and a western façade with three portals, a rose window and fine statues; the church of St. Remy, the Archbishop's palace, which the kings, who were all (except Henri IV.) till the time of Napoleon crowned here, occupied at the time of coronation; the Porte de Mars, a Roman relic, since repaired



THE CATHEDRAL, RHEIMS.

and now in good preservation; the Hôtel de Ville, and some fine old houses. Rheims is a great centre of the champagne trade, and has extensive cellars hewn in the solid rock, and there is a large production of merino, cashmere, flannel, and blankets, as well as dye-works, breweries, tanneries, and worsted-mills. It is a town of great antiquity, and was in the Roman period the capital of Gallia Belgica.

Rhenish Prussia is the district surrounded by Alsace-Lorraine, Belgium, Holland, Hesse, Nassau, Bavaria, and Westphalia, and contains 10,415 square miles. It is hilly in the south, which is occupied by the Eifel and other mountainous country, but most of the land is very fertile, and

produces abundance of cattle, horses, sheep, goats, and pigs. Minerals are plentiful, among them being iron, coal, copper, lead, zinc, clay, gypsum, marble, porphyry and alabaster. The manufactures are important, among them being iron and machine-making, chemical, sugar, glass, and porcelain works, cotton-, woollen-, linen-, and silk-mills, fulling, tanning, paper-making, and much brewing and distilling. There are five governments, and the inhabitants are for the most part Catholic.

Rheostat is an arrangement whose electrical resistance can be readily varied, and is used for adjusting the strength of electric currents. The instrument originally invented by Wheatstone consisted of two cylinders, one of wood and one of brass, fitted in a frame so that they could be turned by handles. A wire was wound in an open spiral partly on one and partly on the other, and springs were provided which rubbed on the ends of the wire to enable it to be introduced into a circuit. The part of the wire wound on the brass cylinder was short-circuited and so cut out; but that on the wooden cylinder was interposed in the circuit. By winding the wire from the brass to the wooden cylinder the resistance could be increased, and *vice versa*. In rheostats of modern construction a number of coils of wire of any required resistance are fixed in a frame, and their ends are connected to brass blocks. By means of a switch lever touching the blocks any of the coils can be introduced into the circuit. In another form a pile of carbon plates is provided with copper connections at the ends, and arranged to be compressed by a screw; the resistance interposed at the points of contact of the plates diminishes as the pressure is increased. A trough of liquid (zinc sulphate, dilute acid, mercury, etc.), having movable connection plates, is also sometimes used as a rheostat.

Rhesus (*Macacus rhesus*), the common monkey of Northern India; length of head and body about 22 inches, tail 11 inches. The fur on the back is brown or rufous, on the limbs and under surface ashy-brown, seat-pads and face (in adult males) red. It is intelligent, but mischievous, and is trained by showmen to perform tricks.

Rhetoric, in a general sense, is co-extensive with eloquence, spoken or written, and embodies the principles of prose composition, and deals with appeals made to the Understanding, Will, or Taste. In a narrower sense, it denotes the Art of Persuasion, and as such addresses itself chiefly to the Will and Emotions. Among writers on rhetoric may be mentioned Aristotle, Cicero (who divided his speeches in a rhetorical manner), and Whately, while Cox's *Advocate* endeavours to apply the principles of rhetoric to bar-oratory.

Rheumatism. *Acute rheumatism* or *rheumatic fever* is a disease in which febrile disturbance is associated with swelling and intense pain affecting various joints of the body. As a rule, one joint after another is attacked, those first affected recovering the normal condition as others are involved; the larger joints, particularly the wrists and knees, are especially liable to suffer, but

almost any joint may be attacked. The disease is often attributed to exposure to wet and cold; it seems to be to some extent hereditary, and generally manifests itself in young adults. It sometimes occurs in association with scarlet fever. In a considerable proportion of cases of rheumatic fever the heart becomes involved in the mischief. Pericarditis may occur, or the fibrous structures of the aortic or mitral valves may be implicated. In this way serious organic disease of the heart is not infrequently set up as the result of an attack of acute rheumatism. Pleurisy and other lung affections are not uncommonly met with in association with the disease. In some cases of acute rheumatism the condition known as hyperpyrexia supervenes, the temperature rising to 108° or even 110° Fahr., with cerebral complications. The treatment of acute rheumatism demands the most careful attention, having regard to the serious mischief which may result from neglect in this malady. Absolute rest in bed until complete convalescence is established is essential, the diet requires to be carefully regulated, and salicylate of soda is usually administered; the condition of the heart requires to be carefully watched. There is, unfortunately, a tendency for rheumatic fever to recur in subjects whom it has once attacked. Gonorrhœal rheumatism is a peculiarly intractable form of joint malady which occurs in some cases of gonorrhœa. For osteo-arthritis (rheumatoid arthritis) see JOINT.

Rhine, THE (German, RHEIN), one of the most important rivers of Europe, receives over 1,200 tributaries, rises in the Grisons, and has three main sources, the Vorder-, Hinter-, and Mittel-Rhein. The



MAP OF THE RHINE.

Vorder comes from three sources, rising to the north-east of St. Gothard, the Mittel from Lake Skur in Dimthal, and the Hinter from the Rheinwald Glacier, flowing 70 miles through Rheinwaldthal. The Mittel-Rhein joins the Vorder-Rhein at Dissentis, and the Vorder-Rhein, flowing east, joins the Hinter-Rhein at Reichenau, from which point it becomes the Rhine Proper, being about 140 feet wide and

capable of conveying floats, and becoming navigable at Chur, where it receives the Plessur. From this point it flows north, leaves the Grisons, receives the Ill, and helps to form the Bodensee and Untersee; then flowing west it separates Switzerland from the Grand Duchy of Baden, and flows on to Schaffhausen and Basel, receiving in its course the Goldach, Thur, Thöss, Glatt, and Aar on the left, and some tributaries from the Schwarzwald on the right. At Basel it turns north and separates Alsace from Baden, Baden from Rhenish Bavaria; then through the Grand Duchy of Hesse, which it separates from Nassau; then separates Nassau from Rhenish Prussia; then enters Rhenish Prussia, receiving many rivers, among them being the Neckar, Wiese, Main, Lahn, and Moselle, and passing the towns of Strasburg, Mannheim, Worms, Mainz, Bingen, Bonn, Cologne, Düsseldorf. Below Emmerich it enters Gelderland (Holland), and divides into North and South, the south branch, called the Waal, joining the Maas, while the north, called the Rijn, flows to Arnhem, dividing into right and left branches, the right forming the old and new Yssel, and flowing into the Zuyder Zee, while the left, still called the Rijn, dwindles and flows into a canal. The river is 750 ft. wide at Basel, increasing to 2,150 ft. at its entry into Holland, while the depth varies from 5 ft. to 50 ft. From the Bodensee to Schaffhausen the river is navigable by steamers, thence to Basel the course is rocky, and in the lower part the river is studded with islands, some of which are cultivated and others covered with timber. Among its fish are salmon, trout, sturgeon, pike, carp, lampreys, and the islands abound in wild-fowl. The navigation of the Rhine is important; loaded vessels ascend to Spire. There are several rapids, and in parts the river flows through narrow gorges. From Basel to Mainz wide side-valleys open towards the Vosges on the left and the Black Forest on the right, while at Bingen mountain ridges descend to the left bank. The towns, villages, tower-crowned heights, vineyards, and side-valleys make the Rhine a favourite resort of tourists.

Rhinoceros, any species of the genus *Rhinoceros*, constituting a family of Perissodactyle Hoofed Mammals. They are huge creatures, of small intelligence, timid in disposition, but formidable foes when irritated or wounded, for they deal terrible blows with their nasal horns. They form three groups, sometimes raised to generic rank: (1) With a single horn, and the skin arranged in definite folds or shields. Here belong the Indian Rhinoceros (*R. unicornis*) and the Javan Rhinoceros (*R. sondaicus*). The latter species, found also in Burma and near Calcutta, is much the smaller, and its shields are differently arranged from those of the Indian form. In the females the horn is small, or it may be wanting. (2) With two horns, and the skin shields less strongly marked than in the first group. The Sumatran Rhinoceros (*R. sumatrensis*), the smallest living form, is the only member of this group, the Hairy-eared Rhinoceros (*R. lasiotis*) from Chittagong being probably only a variety. (3) Two well-developed horns and the absence of definite

shields characterise the third group, which contains the Black Rhinoceros (*R. bicornis*), ranging from Abyssinia to the Cape, and the nearly extinct "White" Rhinoceros (*R. simus*), from the country south of the Zambesi. Both are greyish-black in colour, the latter often the darker. The chief difference is that the former has a prehensile upper lip, and feeds on the branches of trees, and the latter has the upper lip square and grazes. Skins and skeletons of *R. simus* were brought to England in 1894.

Rhinoplastic Operation, an operation designed to improve the appearance of the nose in cases where extensive loss of substance has occurred in consequence of disease. The result is obtained by the transplantation of a piece of skin, usually from neighbouring parts of the face.

Rhizocarps, or HYDROPTERIDÆ ("water-ferns"), a small but interesting group of Pteridophyta (q.v.) comprising two orders, the *Salviniaceæ* and the *Marsileaceæ*, each with two genera, *Salvinia* and *Azolla*, and *Marsilea* and *Pilularia*, with a very small number of species. The *Salviniaceæ* are floating plants; the *Marsileaceæ* live in wet ground, *Pilularia globulifera* being the only British species. In *Salvinia* submerged leaves take the place of roots. The stem in all cases is a slender rhizome. *Salvinia* has broad, flat floating leaves with remarkable air-cavities; those of *Azolla* are minute and two-lobed; *Marsilea* has a long erect circinate petiole, with four cuneate leaflets at its apex; and in *Pilularia* the blade of the leaf is suppressed. All Rhizocarps are heterosporous and leptosporangiate. The *Salviniaceæ* bear male and female sori on the same plant, developed from the tip of a leaf-lobe, and surrounded by an indusium, the male containing numerous microsporangia, the female, from one to twenty-five megasporangia. The *Marsileaceæ* have more complex sporocarps, each representing the blade of a leaf-segment and enclosing numerous sori, each of which contains both microsporangia and megasporangia. It is the globular sporocarp to which *Pilularia* owes its name of "pill-wort." *Azolla* contains filaments of an alga (*Anabæna*), living symbiotically in pits in its leaves. *Marsilea* includes the nardoo of Central Australia, upon the starchy spores of which the Burke and Wills expedition starved.

Rhizocephala, a group of degraded parasitic Crustacea which live on the abdomen of crabs and hermit crabs. They were once regarded as a distinct order, but are now known to be members of the Cirripedia which have suffered degeneration owing to their parasitic habits.

Rhizome, an underground shoot, generally horizontal, often fleshy and with more or less numerous and elongated internodes. It derives its scientific name and its popular designation of *root-stock* from its root-like appearance, and when the older part dies it forms what is termed a *premorse root*, as in the primrose and the scabious. The elongation of the rhizome may be unlimited (*indefinite*) or limited (*definite*). In the former case it

continues to elongate at its apex, and bears either only foliage-leaves, as in bracken; or foliage-leaves and scales in regular alternation, with annual shoots arising from their axils, as in the wood-sorrel; or only scales, with annual shoots in their axils, as in Herb Paris. The definite branching is more common, when the apex grows out into an aerial annual shoot, and one or two branches are given off from the axils of scales at its base. If the older part persist, a sympodium (q.v.) is formed, which may be either bilateral, as in ginger, or unilateral, as in Solomon's-seal. If the older part perish, as in the common buttercup (*Ranunculus acris*), each annual shoot forms a new individual by "innovation." The term rhizome is applied also to the rare case of vertical growth of such a sympodium, as in the water-hemlock (*Cicuta*). The wiry rhizomes of the sand sedge (*Carex arenaria*) bind together wind-blown sand-dunes. Those of many plants store up large quantities of starch, as in the arrowroots, and they may resemble a chain of corms, or when abbreviated, as in *Arum*, a single corm (q.v.).

Rhizopoda is one of the subdivisions of the phylum Protozoa (q.v.), and includes all those in which the animal is provided with the thick, irregular, and non-vibratile processes from the body known as pseudopodia. These serve either for locomotion or in the procuring of food. In the typical cases the pseudopodia vary in shape and position, being withdrawn from one place and protruded in another; sometimes, however, they are stable, but are always retractile. In the first stage in the life-history, a whip-like process or flagellum may be present, but this never occurs in the adult. There are seven classes:—

- (1) Heliozoa, or Sun-animalculæ.
- (2) Radiolaria, or Polycistina.
- (3) Foraminifera.
- (4) Amœbina, including the Proteus-animalcule.
- (5) Mycetozoa, or Fission-fungi, which are possibly vegetable.
- (6) Labyrinthulidea.
- (7) Proteomyxa, including a group of primitive and little-known forms.

Rhode Island, from which one of the United States takes its name, is in Narragansett Bay, lat. 41° 25' N., long. 71° 20' W. It is 15 miles long by 3½ broad, and contains the townships of Newport, Portsmouth, and Middletown. The land is fertile, and the climate wholesome and pleasant, and many invalids from the south resort hither. Many sheep, cattle, and horses are reared.

Rhodes, an island and city in Asiatic Turkey, S.W. of Asia Minor, from which it is separated by a channel 10 miles broad. It has a length of 50 miles, and a breadth of 16. Mount Artemira in the centre is 4,068 ft. high, and from it the land, which is fertile, slopes in a series of plains to the sea. The climate is pleasant, and many rivulets water the land. Wine, figs, and oranges are exported, and corn, cotton, and olives are grown. Rhodes was a place of much interest in ancient times, especially for its maritime renown and its excellent maritime laws. Colonised first by a people from Western Asia, and then by Dorians, it sided sometimes with Athens, sometimes with Sparta, in the

Peloponnesian Wars, being afterwards subdued by Alexander the Great and forming a province under the Romans. In 651 it became Mohammedan, and from 1309–1522 it was in the hands of the Knights of St. John, since which period it has been Turk. The town, which is at the north-east end of the island, has many mosques, a convent, and the palace of the Grand Masters. The noted harbour is now half silted up, and is divided into two by a ruined mole, upon which is a lighthouse. The famous Colossus probably stood between the outer and inner harbours, and was overthrown in 278 B.C. by one of the earthquakes to which the island is subject. After lying for 800 years, it was broken up and the metal sold by the Saracens. Rhodes has undergone many sieges, the last being one of seven months by the Turks in 1522.

Rhodes, CECIL (b. 1853), South African statesman, was born in Hertfordshire, and in early life went to the Kimberley diamond-fields, where he made a large fortune, and, returning to England, graduated at Oxford. He went back to the Cape and, entering its Parliament, speedily became Premier. He has taken a great share in gaining the British South Africa Company's charter and in colonising Matabeleland.

Rhodium (RH 104), a rare metal discovered at the beginning of the present century by Wollaston. The metal occurs in only a few rare minerals usually associated with platinum and its allied metals. It has a specific gravity of 12.1, and is a silver-white metal resembling aluminium in appearance. It is insoluble in acids, but as an alloy may be dissolved by *aqua regia*. The solutions of its salts form rose-red liquids, from which fact the name of the element was derived.

Rhodiya (*Rodya*), a primitive people of Ceylon, often confounded with, but distinct from, the Veddahs; occupy the upland valleys of the western highlands; tall, well-made, with regular features; speech quite distinct from the Singhalese or Dravidian; call themselves Buddhists, but are really demon-worshippers, and practise both polygamy and polyandry; are treated as outcasts by the Singhalese, and appear to be dying out.

Rhododendron, a widely-diffused genus of shrubs and trees belonging to the heath tribe, with broad evergreen leathery leaves, and showy clusters of funnel-shaped or sub-campanulate, five-lobed, slightly mono-symmetric flowers, with ten stamens, generally declinate and dehiscing by pores. The genus is not separable from *Azalea* (q.v.). Most of the species are Indian, where some grow as epiphytes, as does also *R. Brookeanum*, of Sarawak. *R. nivale* grows at an altitude of 17,000 feet in the Himalayas; *R. lapponicum* on the shores of Davis Strait; *R. ponticum*, the honey of which is said to be poisonous, the commonest species in our gardens, is hardy and grows from self-sown seed in England; and *R. catawbiense* and others are natives of North America. Numerous hybrids have been raised in our nursery-gardens, and the flowers vary immensely in size, shape, spots, and in shades of white, red, and lilac.

Rhombozoa, one of the two subdivisions of Mesozoa (q.v.), a group of interest, as it is supposed to contain organisms which are intermediate between the multicellular animals or Metazoa and the unicellular forms or Protozoa.

Rhone, THE, rises in Switzerland, a few miles from the source of the Rhine, having its origin in the Rhone Glacier (5,581 ft.). At first it flows rapidly from fall to fall, west through Valais, and enters the Lake of Geneva at the east end, flowing out in a deep blue stream at Geneva in the south-west. Receiving the Arve, it flows south-west to the French frontier, then south between Ain and Savoy, north-west to Lyons (where it receives the Saône), south to Avignon, south through the Bouches-du-Rhone department and into the Gulf of Lyons. At Arles it divides into two branches, the old Rhone, south-west, the delta of which is known as the Île de Camargue, and the Grand Rhone to the south, which falls by two mouths into the Gulf. The chief towns passed are Geneva, Lyons, and the Provençal towns—celebrated by Daudet—Avignon, Tarascon, Beaucaire, Arles. Of its course of 580 miles, 200 are in Switzerland, and 360 are navigable. Its basin is 38,000 square miles in area. The chief tributaries on the right bank are the Ain, Saône, and Ardèche, and on the left the Arve, Isère, Drôme, and Durance. Canals connect the Rhone with the Rhine, Seine, Loire, and Garonne.

Rhopalocera. [BUTTERFLY.]

Rhubarb, the general name now applied to the genus *Rheum*, perennial herbaceous plants belonging to the order Polygonaceæ and mostly natives of Central Asia. They have thick rhizomes, large sheathing petioles to their broad radical leaves, and much-branched panicles of small white, green, or pink trimerous flowers. The name is variously derived from the Greek *rheo*, "I flow," or more probably from *Rha*, an ancient name for the Volga, on whose banks *R. Rhaponticum* still grows. The ancient Greeks recognised two sorts, the Asiatic or *Rha ponticum*, and the Scythian or *Rha barbarum*. *R. palmatum*, first found wild by Colonel Prejevalsky, in the extreme north-west of China, in 1872–73, is the true source of the drug known as Turkey Rhubarb, because formerly imported *viâ* Anatolia. It is now brought to Europe *viâ* Kiakhta and through Russia. The rhizome, when dry, is covered with a yellow powder, appears mottled red and yellow when broken, has a bitter astringent taste, and is gritty from crystals of acid oxalate of calcium. Our imports are about 350,000 lbs. annually. *R. Rhaponticum*, a native of Russia, cultivated in England since 1573, is now grown on an enormous scale, especially near London, for the sake of its pleasantly acidulous leaf-stalks, which are used in tarts, jam, etc., or in the manufacture of "champagne." This species and *R. officinale*, from South-East Thibet, are grown at Bodicott, near Banbury, for medicinal purposes. There are several preparations of rhubarb root in the Pharmacopœia, the drug being extensively employed as an astringent and bitter stomachic, and in larger doses as a purgative. The compound

rhubarb pill in five-grain doses is often given as an aperient, and the compound rhubarb powder (Gregory's powder) is frequently administered to children.

Rhyme (properly "rime," the usual spelling being the result of confusion with the word "rhythm"), the art of composing poetry so far as its measure, etc., are concerned. Rhyming is sometimes taken in the narrower sense of similarity of sound in the endings of verses, and is in this sense an invention of post-classical times. The most common rhyme is the one-syllabled or male rhyme, *e.g.* *gave, save*, a rhyme which is largely employed in English and German, where monosyllables abound, and the double or female rhyme, *e.g.* *bitter, glitter*, which is more common in Italian and Spanish poetry. The French employ both. The triple rhyme also is found in all these languages. European rhyming is thought to have taken its origin in the Latin hymnology of the Church, while the Teutonic and Norse poetry was distinguished by its alliterations. Leonine rhyme is that which rhymes at the middle as well as at the end of verses. Byron, Swinburne, and Browning may be cited as great masters of the art of rhyming.

Rhyncholites, the fossil beaks of the Cephalopoda and belonging to the division known as the Tetrabranchiate. They are fairly common in those zones of the Chalk which contain many Ammonites.

Rhynchonella is one of the best-known of the still surviving genera of the Brachiopoda or Lamp-shells. It is the type of the *Rhynchonellidae*, and dates from the Palæozoic period onward. It is especially characteristic of the Oolitic and Cretaceous rocks.

Rhynchota, an order of insects also known as the Hemiptera. The order is characterised by the presence of four naked membranous wings, by the facts that the mouth appendages are so modified as to enable the insect to feed by suction, and the caterpillar and adult stages are not sharply-separated by a fixed chrysalis stage; the animal in the intermediate stage is active. The order is a very large one, numbering about 20,000 described species; the oldest known form is *Eugereon*, from the Permian deposits. The Rhynchota are divided into two groups: (1) the Heteroptera or Bugs, in which the front pair of wings are horny and the hind wings soft and membranous; (2) the Homoptera, in which all four wings are membranous. There are numerous families in both suborders. Among the Heteroptera the best-known forms are the Shield-bugs (or *Scutelleridae*), the Chinch-bug or *Blissus* (one of the *Lygaeidae*) which devastates the cornfields of America; the Bed-bugs or *Cimicidae*, of which the best-known English species is *Cimex lectularius*, which first became abundant in England after the Fire of London, when it was introduced in timber; the large Wheel-bugs (*Reduvius*); the Water Scorpions or *Nepidae*, of which *Nepa cinerea* (Linn.) is the largest English species, and the Water-boatmen or *Notonectidae*. The Homoptera include the more interesting members of the order. The first family is that of

the *Cicadidae*, of which there is only one English species (*Cicada Anglica*, Curt.); the Cicadas abound in the tropics, where their chirping enlivens the woods day and night. The *Fulgoridae* include the Lantern-flies and Candle-flies, some species of which are said to be luminous, though the records are not free from doubt. The frothy masses found on grass and known as "Cuckoo-spit" enclose the yellowish larva of *Aphrophora spumaria* (Linn.), which is the best-known member of a third family, the *Cercopidae*; this also includes the Froghoppers. The Plant-lice or Aphides (q.v.) form another family. The Scale-insects or *Coccidae* also belong to this sub-order. The females of this family produce several important products such as cochineal (yielded by *Coccus cacti*, Linn.) and shellac (by *Coccus lacca*, Kerr). Both Heteroptera and Homoptera occur in the Jurassic, and are there represented by Cicadas, Water-boatmen, etc. The Plant-lice are known first in the Wealden (Lower Cretaceous).

Rhythm strictly means measured time, and is equally applicable to dancing, music, poetry, and prose. Rhythm is the heart of dancing as it is of music. In classic prose rhythm was governed by more or less rigid rules; in modern prose it is to a great extent a question of taste. In classic poetry rhythm was almost the one test of formal excellence; in modern poetry it is to some extent modified by other principles. [METRE.]

Rhytina (*Rhytina stelleri*), the Northern Sea Cow. This animal, closely allied to the dugong and manatee, was from 20 ft. to 25 ft. long, of a brownish colour, sometimes marked with white, and had horny plates instead of teeth. It was discovered by Steller in 1741 in the shallow bays round Behring's Island; and in less than thirty years the species was exterminated by the Russian traders, who killed these creatures for food. Nordenskiöld believed that some few survived till 1854, but this is not generally accepted.

Ribbon Fish, a division of deep-sea spiny-finned fishes widely distributed. Specimens of from 15 ft. to 20 ft. long have the body about a foot deep, with a maximum thickness of two inches.

Ribbonism was the name bestowed upon the principles professed by a Roman Catholic society founded at the beginning of the 19th century with a view to counteract the influence of the Orange society. The members were mostly of the lower classes, and differed in their aims and objects in different times and places.

Ribbon Worms, a popular name for the worms belonging to the *Nemertea*.

Ribes, a genus of shrubs forming a well-marked tribe of the order Saxifragaceæ (q.v.), comprising some sixty species, mostly American, but including the European *R. Grossularia*, the gooseberry (q.v.), *R. rubrum* and *R. nigrum*, the red and the black currant (q.v.). They have scattered lobate leaves; racemes of flowers with a five-lobed coloured calyx, five petals and five perigynous stamens; and many-seeded berries. *R.*

sanguineum, the red-flowered currant, a native of western North America, is a favourite in our flower-gardens.

Ribs. The ribs, twelve in number on each side, enter largely into the constitution of the bony framework of the thorax. They articulate behind with the dorsal vertebræ, the head or posterior extremity presenting two facets for articulation with the bodies of two contiguous vertebræ, while each rib also articulates with the transverse process of the lower of the two vertebræ with which the head is connected. Anteriorly the first seven ribs on each side are joined by their cartilages to the sternum (true ribs). The cartilages of the ribs below these are not inserted directly into the sternum (false ribs), and the eleventh and twelfth ribs are quite free anteriorly, whence their name of floating ribs. The spaces between the ribs are termed the intercostal spaces, and across these pass the two sets of muscular fibres called the external and internal intercostal muscles. The inferior border of each rib presents internally a groove, the subcostal groove, in which the intercostal vessels and nerve lie. Fracture of the ribs is not an uncommon result of violence, and this accident assumes a serious character if the underlying pleura and lung are involved in the injury.

Ricardo, DAVID (1772–1823), economist, was born in London of Jewish parents. His father was on the Stock Exchange, and the son, on leaving school, became his confidential assistant. His abjuration of the Jewish faith, however, and his marriage against his father's wish, led to their separation, and the younger Ricardo started as a member of the Exchange on his own account, and speedily acquired a great fortune. He began to study economics, and in 1810 wrote his first work, dealing with the depreciation of the currency. This went through several editions, and in 1817 he issued his most important work, *On the Principles of Political Economy and Taxation*, which has remained a leading authority on its subject. In 1819 he entered Parliament as member for Portarlington. His works were collected and published by McCulloch, in 1846. His name has become, rather unjustly, a sort of symbol of the "abstract-deductive" method in economics.

Rice (*Oryza sativa*), a cereal grass which supplies food for a greater number of human beings than any other plant, is a native of India, tropical Australia, and possibly China. It is one of the most prolific of crops, growing best in alluvium liable to inundation, and requiring a temperature of 60° to 80° F. to ripen. The inflorescence is a panicle: there are six stamens to the flower, and generally an awn. The grain is poorer in fat, potash, or gluten than wheat, only containing 7 per cent. of the latter, as against 12 per cent. in maize, 14 in oats, and 22 in wheat. It is, therefore, a purely farinaceous food, and should be supplemented by milk or other more nitrogenous food. It is said to furnish food to one-third of the human race. Unknown to the Jews or Egyptians, and

known to the ancient Greeks only as a curiosity, the plant was introduced into Spain by the Arabs as "aruz," and was first grown in Italy as "rizo" in 1468, though it is mentioned by Horace. It was not introduced into Carolina until 1700. We import about 400,000 tons annually, of a value of 3½ millions sterling, mostly from Bengal and Aracan. It is used in distilling and largely for starch, as well as for food. Its starch-grains are the smallest known. Saké, the national drink of Japan, is brewed from it.

Rice-Bird. [BOBOLINK, JAVA SPARROW.]

Rice-Paper is a paper manufactured in China from the pith of *Patsia papyrifera*, a plant belonging to the ivy family (Araliaceæ), native of swampy forests in Formosa. It is cut in a spiral manner, and often dyed, and is used for painting, and to make artificial flowers.

Richard I. (1157–99), the crusader, surnamed CŒUR DE LION, succeeded his father, Henry II., in 1189. In the following year he started on a crusade which he had been meditating for some time. He joined his forces with those of Philip Augustus of France, and the combined numbers amounted to 100,000. The two kings quarrelled in Sicily, and the reconciliation was only effected by Richard paying a large tribute. Journeying by different routes, Richard entered Cyprus, which he captured and handed over to Guy de Lusignan, and there married the Princess Berengaria of Navarre. Acre was taken by the joint forces, and shortly after Philip returned to France, leaving 10,000 of his men with Richard, who performed prodigies of valour, and totally defeated Saladin at Cæsarea. On his return home he was shipwrecked and was for a long time imprisoned by Henry VI., who demanded and received an enormous ransom from England. Richard arrived home in 1194, and very shortly after made war on France, in consequence of a breach of an agreement by Philip. He was mortally wounded by Bertrand de Gourdon, at the siege of Chalus, in revenge for cruelties to the family of De Gourdon, and though he ordered Bertrand's release, the latter was put to death in an atrocious manner. Richard bequeathed his heart to Rouen, where it still is. He was of a sanguinary disposition, but of remarkable valour. Of his ten years' reign not more than six months was spent in England.

Richard II. (1366–1417?) was the son of Edward the Black Prince and Joan, the Fair Maid of Kent, and became Prince of Wales after his father's death in 1376, succeeding his grandfather, Edward III., in 1377. During the early years of his reign various rebellions and conspiracies arose, notably Wat Tyler's. In 1382 he married the estimable Princess Anne of Bohemia, and in 1386 was temporarily deposed by his ambitious uncles, Gloucester and Lancaster. He again assumed power, however, in 1389, and banished Gloucester. In 1394 his queen died, and two years later he espoused Isabella of France, then only seven years of age, and concluded the war with France which had been raging. Both marriage and truce were

unpopular, and Gloucester, who was assisting in the formation of another rebellion, was put to death. Lancaster, however, with the aid of other nobles, forced him to resign the crown, and according to some accounts he was murdered in Pontefract Castle. Others state that he fled to Scotland and lived there till about 1417.

Richard III. (1450-1485) was the son of the Duke of York and brother of Edward IV., and in his 11th year was made Duke of Gloucester and Lord High Admiral. He was present at the battle of Tewkesbury, and went to the French war in 1475, and headed the Scotch expedition of 1482. His cruel inclinations were developed early, and he was suspected of the murder of Prince Edward and of Henry VI., and certainly caused the death of his brother, the Duke of Clarence, in 1478. When Edward IV. died Richard treacherously caused his nephews to be sent to the Tower, where he afterwards had them murdered, declaring that they were illegitimate. In 1483 he was proclaimed king, was conspired against by Buckingham, Richmond, and others, whom he in most cases sent to the scaffold, and on August 22nd, 1485, was killed at the battle of Bosworth. He was the last of the Plantagenets.

Richard de Bury (1281-1345), Bishop of Durham and Chancellor of England, was born in Suffolk, and is chiefly known as author of the *Philo-Biblon* and as a great book-collector. He was tutor to the future Edward III. at Oxford, and formed there the largest private library then in existence. The *Philo-Biblon* commemorates his love of books. His library he left to Oxford, where he had been educated.

Richard of Cirencester, an early English chronicler, who was a monk at Westminster. He was famous for a long time as the supposed author of a treatise on Roman Britain entitled *De Situ Britannie*, which was considered of enormous value, till it was proved to be a modern imposture, palmed off on Dr. Stukely in 1757, by a Copenhagen professor. Richard became a monk in 1350, and died about 1401. Very little is known of him or his writings.

Richardson, SAMUEL (1689-1761), novelist, was born in Derbyshire and was the son of a joiner, but was of good descent, and was destined for the Church. His father, however, had not the means to carry out his idea, and he was apprenticed to a printer in London, in his 17th year, having received but a slight education. His conduct during his apprenticeship was exemplary, and he was able to devote some time to study. He married his master's daughter, and soon after started a printing business of his own. Through the influence of Onslow he obtained the printing of the Journals of Parliament. He gave such attention to his business, and was so industrious and enterprising in developing it, that he made it a great success, and this prevented him from appearing as an author until he was over fifty years of age. He was then induced to write by his booksellers requesting him to furnish them with a volume of familiar letters. He then decided to

write *Pamela* in epistolary form, the story having been suggested to him by one he had not long before listened to. The first part appeared in 1740, and had been composed in two months. Two other volumes followed, and the whole work received the warmest praise from his contemporaries, Pope declaring it would do more good than twenty sermons. *Clarissa Harlowe*, which is generally conceded to be Richardson's masterpiece, was published in 1748. Five years later his *Sir Charles Grandison* appeared, and was not so successful, its moral tone being somewhat over-emphasised. With the exception of an essay or two, it was his last work. Richardson was undoubtedly a great novelist and a great English writer, but his books are more talked about than read, being, in general, too tediously drawn out. They are illuminated by flashes of true sentiment and contain many fine scenes. His only personal fault was his vanity, and Dr. Johnson, a great admirer, tells us he did little else than talk about his works. His correspondence was published in 1803 in six volumes, with a life by Mrs. Barbauld.

Richelieu, ARMAND JEAN DUPLESSIS, CARDINAL DE (1585-1642), was of noble family and was born in Paris. He studied at the Colleges of Navarre and Lisieux, and would have entered the army but that his elder brother, Bishop of Luçon, resigned his see, and it was decided that the younger brother should obtain it. Henry IV. consented to the arrangement, and Richelieu began to study with that object, taking his doctor's degree at the age of 20. In 1607, with some hesitation, the Pope consecrated him, and soon after he was elected to the States-General by the Poitou clergy as their deputy. He was favoured by Marie de Medicis, and in 1616 was appointed Secretary of State, and soon gained great ascendancy over the young Louis XIII. and his mother. When Marie de Medicis incurred the displeasure of the Court, he was banished, but he cleverly effected a reconciliation, and was before long recognised as the most powerful man in France. In 1622 he was created a cardinal, and in 1624 took his seat on the Supreme Council. Till his death, eighteen years later, he practically governed France. One of his most cherished plans was to curtail the power of the nobles and render the crown more independent and powerful, and in this he succeeded. The encroachments of the nobility were stopped, and they became dependent on the king, instead of the reverse, which had for some time previous been the case. Richelieu, being quite unscrupulous, considered any means justifiable, and sent many a noble head to the scaffold and the dungeon. He next subdued the Calvinists, and in person laid siege to their stronghold, La Rochelle, which he captured. He, however, had only a political purpose, and allowed them freedom to follow their religion without molestation. His greatest service to France, perhaps, was the humbling of the house of Austria, which then had enormous influence in Europe. To gain his ends he roused the Protestants against the Austrian emperor, and in several countries and by all manner of devious methods worked at the

sapping of Austria's power. He finally reduced it to the subordinate position it had held before the death of Charles V. The closing years of his life saw the rise of Cinq-Mars' conspiracy, but Richelieu triumphed, and the conspirators were punished. He founded the French Academy and did much for France. It was largely due to him that Germany, Spain, and Savoy were kept in check so long. He was buried in the Sorbonne, where he had been educated.

Richmond. 1. A municipal borough and town in the North Riding of Yorkshire, 42 miles N.W. of York, is on the left bank of the Swale, which is crossed by a stone bridge a little below the town. The town is on a height above the river, and has an ancient town-hall, two churches, one of which dates from Henry III., and a fine old ruined castle with a keep 100 feet high, which overhangs the river. The grammar school is well known in North Yorkshire. Among the industries are iron- and brass-working, rope- and paper-making, and tanning, and there are training stables in the neighbourhood. Near are the ruins of Easby Abbey. A branch of the North-Eastern Railway serves the town. Richmond no longer sends a member to Parliament.

2. Richmond, formerly called SHEEN, a noted town in Surrey, upon the Thames, here crossed by a stone bridge of five arches, 12 miles S.W. of London. It has several churches, and many almshouses. The town is partly upon Richmond Hill and partly on a plain, and is surrounded by beautiful scenery and interesting seats, and is a favourite resort for members of London society who seek change and recreation. The Royal Park, eight miles in circumference, was enclosed by Charles I.

3. The capital of Virginia, United States of America, is at the head of the tide-water near the James river, 100 miles S.W. of Washington. The streets are wide and at right angles, and the Shockoe creek flows through the centre of the town. Capitol Square (a park of nine acres) has the Capitol in the middle, with portraits and the state library, Washington monument, Foley's statue of General Stonewall Jackson, and a statue of General Lee. Among public buildings are the Governor's house, the town-hall, and the Federal buildings. There are many parks, and a beautiful cemetery (Hollywood) which has natural scenery. Bridges connect the town with its suburb Manchester. The great water-power from the falls is of great use in the industries, which deal chiefly with iron, tobacco, grain, and flour. There is ready steam and railway communication. During the Civil War Richmond was capital of the Confederate States.

Richter, JEAN PAUL (1763-1825), German romancist, was born near Baireuth, and was the son of a poor clergyman. Sent in 1781 to Leipsic University to study theology, he found himself irresistibly attracted to literature, and he began to write. His first productions are very immature and unreal, and are not now read. He could find no publisher for some time, and to keep himself and his widowed mother he was obliged to work hard as a tutor. In 1792 his *Invisible Lodge*, the

earliest of his really original books, was brought out, and was well received. The next, *Hesperus* (1792-94), is still considered by many to be his masterpiece. He commenced to develop his own peculiar style, and his sentimentality found enormous favour. By the publication of his *Quintus Fixlein* and his *Flower, Fruit, and Thorn Pieces* (1795), he at once sprang into the front rank of German authors, and was for a long time distinctly the most popular of them all. He wrote on philosophy and other subjects for a while, married, and settled in Baireuth, and then produced some of his most amusing books, such as *Dr. Katzenberger's Trip* (1808), as well as patriotic works of the stamp of his *Twilight for Germany* (1809). Having done his best work, he retired on a small pension, and lived much by himself during his last years, which were saddened by his blindness and the death of a cherished son. Richter was unquestionably one of the greatest of humorists, but he is sometimes merely maudlin in sentiment, and his terrible diffuseness militates against his popularity; but there are passages of exquisite and almost unequalled beauty in some of his works, and Carlyle's admiration of him is well known. His writings have been collected into 65 volumes. The calmness and penetrating humour of his best works impress readers, and, despite certain manifest faults in them, his is one of the greatest names in German literary history. He is, however, not so widely read by his countrymen of the present day.

Rickets (*Rachitis*) is a disease of childhood, in which the bones do not assume their normal hardness, and are thus liable to yield unduly, with resulting deformity. In rickets there is usually thickening of the joint ends of long bones, and there is often also enlargement of the liver and spleen, and general *malaise*. The abnormalities resulting from the yielding condition of the bones are most obviously manifested in curvature of the bones of the legs, with resulting knock-knee, and in curvature of the spine with exaggeration of the normal curves, and often lateral rotation of the bodies of the vertebræ, again in the deformed condition of the thorax, which is known as "pigeon-breast," in the delayed closure of the fontanelles of the skull, and in the prominences of the frontal and parietal eminences which are such characteristic appearances in the rickety cranium. There is usually, moreover, enlargement of the anterior extremities of the ribs, producing the beaded condition which is readily detected on passing the hand over the lateral aspects of the chest. Rickets usually manifests itself during the second year of life, and is often associated with conditions of poverty. It appears to be undoubtedly aggravated, if it be not actually caused, by improper diet. The majority of cases of rickets occur in children brought up by hand, and in such cases cross-examination usually elicits the fact that the most unsuitable articles of diet have been supplied to the child. Treatment consists in the administration of nutritious diet, with tonic remedies, and especially cod-liver oil. Sea air is said to be particularly valuable in this malady. It is

necessary to do all that is possible to obviate strain upon the bones, such as would be calculated to increase deformity.

Ridley, NICHOLAS (1500?-55), martyr-bishop, was born in Northumberland, and became a fellow of Pembroke College, Cambridge, in 1524, and eventually master of Pembroke. His favourite walk in the orchard is still called after him. His learning was so extensive and his reputation as a scholar so great that Oxford desired his services, but its offer was refused, and Ridley proceeded abroad, where he pursued his studies. At Cambridge he protested against Papal interference, was made royal chaplain by Cranmer, and successively Prebendary of Canterbury, Canon and Bishop of Rochester (1547). In 1550 he became Bishop of London, and strongly objected to the use of holy water, and otherwise expressed strong views against such practices. He favoured Lady Jane Grey against Mary, who put him in the Tower in 1553, and after eight months' imprisonment there he was taken to Oxford, tried, adjudged a heretic, and burnt with Latimer (q.v.) in front of Balliol College, on October 16th, 1555. He denied the doctrine of the real presence. He is described as "small in stature, but great in learning."

Rienzi, COLA DI RIENZO (1313-54), Roman tribune, was born at Rome, and, though the son of a water-carrier, managed to secure a good education. The eloquence which was perhaps his most notable characteristic came to him in early youth, and, as a warm admirer of Petrarch, he shared that poet's views of the ancient glories of the Eternal City, and imagined it possible to restore its former prestige. He was sent with Petrarch to Pope Clement VI., who was at Avignon, and was made Vicar-Apostolical. Recognising the misery of the people of Rome, he championed their cause, and became immensely popular. He was made tribune, and in May, 1347, the people formed a republic, with, curiously enough, the consent of the Pope. Rienzi governed well for a time, but made various mistakes, and at length had to flee when his dictatorship became insupportable. After his arrest and subsequent imprisonment, he was again sent to Rome as governor, by the Pope. He was welcomed with acclamation, but was assassinated soon after by the populace, who were in a wretched condition. Lytton's romance has made his name familiar to English readers.

Riesen Gebirge ("GIANT MOUNTAINS") belong to the Sudetic chain, and separate Silesia from Bohemia and Moldavia, joining the Carpathian system, though the name is sometimes confined to the range between the sources of the Neisse and Bober. There are picturesque valleys and lofty peaks, *e.g.* Schneekoppe (5,257 feet), Borenberg, and Grand Rad (5,156 feet).

Rifle, a kind of firearm whose peculiarity consists in the barrel being grooved instead of smooth-bored, the grooving having more or less of a twist, thus insuring greater accuracy of flight for the bullet, since it bores, as it were, its way through the air, and presents every side of the projectile in turn to the lateral resistance. The invention is not new, and was known on the

Continent in the 15th century, but was not introduced into the British army till the first American War, the Americans being the first demonstrators of its superiority. The weapon was not used generally in the British army till about the time of the Crimean War. The first improvement in it was the introduction of the elongated bullet, which underwent various modifications tending to improvement in range and accuracy. The Enfield rifle, which on the introduction of breech-loading was converted into the Snider, gave place to the Henry-Martini, which, although a most serviceable weapon, has been superseded by the Lee-Metford magazine rifle. The tendency of modern improvements has been in the direction of increasing the twist of grooving to a degree once thought inadvisable, and of diminishing the calibre, the net result being a greater degree of penetration, a longer range, and a lower trajectory. In 1858 the principle was applied to cannon, both Armstrong and Whitworth having been very successful in their manufacture.

Rifle-Bird (*Ptilorhis paradiseus*), one of the Plume-birds from South-Eastern Australia. The popular name is said to have been given by the early settlers, who saw in the plumage of the male (velvety black above and olive-green below) some resemblance to the uniform of the Rifle Brigade.

Riga, town and port of Russia, capital of Livonia, on both banks of the Southern Dwina, five miles above the Gulf of Riga, and 312 S.W. of St. Petersburg. It is situate on a sandy plain surrounded by hills, and has extensive suburbs. The modern town is well built, has good squares, wide quays, an esplanade, and gardens, and the river is crossed by a bridge of boats. Among the chief buildings are the cathedral, St. Peter's church (with lofty spire), an old castle, arsenal, etc. The chief industries are the manufacture of starch, soap, cards, artificial flowers, and brandy, and there is a very extensive export and import trade, and numerous vessels frequent the port. The Gulf of Riga is on the coasts of Courland, Livonia, and Esthonia, and is 120 miles long by 70 broad. The navigation is dangerous, and on the north-west the gulf is almost closed by the island of Oesel. The Southern Dwina flows into the gulf.

Right Ascension. [ASCENSION, RIGHT.]

Right of Way. [WAYS.]

Rights, BILL OF, a declaration delivered by the Lords and Commons to the Prince and Princess of Orange, February 13, 1689, and afterwards enacted in Parliament when they became king and queen. It sets forth that King James, by the assistance of evil counsellors, endeavoured to subvert the laws and liberties of the kingdom by exercising a power of dispensing with and suspending of laws, by levying money for the use of the Crown by pretence of prerogative without consent of Parliament, by prosecuting those who petitioned the king and discouraging petitions, by raising and keeping a standing army in time of peace, by violating the freedom of election of members to serve in Parliament, by violent

prosecutions, and the causing partial and corrupt juries to be returned on trials, excessive bail to be taken, excessive fines imposed, and cruel punishments to be inflicted, all of which were declared illegal. The declaration concludes in these remarkable words:—"And they do claim, demand, and insist upon all and singular the premises, as their undoubted rights and liberties." The Act of Parliament above referred to (1 Will. & Mary, statute 2, c. 2) itself recognises "all and singular the rights and liberties asserted and claimed in the said declaration to be the true, ancient, indisputable rights of the people of this kingdom."

Rigi, an isolated peak in the canton of Schwyz, is between the Lakes Zug and Lucerne, and rises to a height of 5,900 feet. It commands fine views, and is a hackneyed resort of tourists, who can ascend by either of two railways to the hotels at the summit. These railways are worked by means of a toothed wheel and rail.

Rigidity is that property possessed by a solid which causes it to experience no deformation or strain when a stress is applied to it. The fraction $\frac{\text{stress}}{\text{strain}}$ —the *co-efficient of rigidity*—in this case is

infinitely great. No substance is, however, perfectly rigid. Every substance yields under the action of a stress if we take small enough masses of them, such as thin wires; but some solids, such as steel, have a very large co-efficient of rigidity, and unless a considerable stress is applied to them the corresponding strain is too small to be observed.

Rigor Mortis, the condition of rigidity which affects the muscles of the body after death, brought about by the coagulation of the myosin, which is an important constituent of muscle. The muscular fibres become shortened, and there is consequent contraction, associated with the general stiffening. Rigor mortis usually commences within an hour or two after death, and extends, generally speaking, from above downwards; the condition passes away when putrefaction sets in.

Rigsdag. [DENMARK.]

Rimini (Roman *Ariminum*), an Italian town in the province of Forlì, 24 miles S.E. of Forlì, is situated in a plain, and is on the Milan-Brindisi Railway. The town is walled, and has some fine marble palaces, a 14th- and 15th-century cathedral (the work of Alberti), the church of St. Giuliano (with a Paul Veronese altar-piece), that of St. Girolamo, a triumphal arch of Augustus, and the bridge of Augustus over the Marecchia. This bridge of five arches is of white marble and still in good condition. The former harbour is now silted up. Silk, glass, and earthenware are manufactured; there is a good trade in corn, silk, fish, and salt.

Rinderpest. [CATTLE PLAGUE.]

Rinds, a numerous people of Baluchistan, especially in the province of Kachi and in the Mand district of the province of Makran; are usually classed as one of the three great branches of the Baluchi family, but appear to be originally of Jat

stock with a slight infusion of Arab blood (hence their claim to Arab descent); are Mohammedans, and speak the Northern Baluchi dialect. (W. L. DAMES, *Journal of the Royal Asiatic Society*, 1881.)

Rings have been used by mankind at least from the age in which metals began to be worked. They were in use among the Assyrians, the Egyptians (who used a great variety of rings and displayed much artistic taste in their manufacture), the Greeks, the Romans, and indeed among most civilised peoples. Whether they were at first symbolic of eternity or of sexual relations is a matter of doubt, but it was early used as a sign of authority, dignity, and honour. Jupiter gave Prometheus a ring, Pharaoh confirmed Joseph's authority by a ring, bracelets and rings were presented by Eliezer to Rebecca. Among the Romans wearing a ring was a privilege of the equestrian order, and at a later period gladiators wore bracelets. With the Anglo-Saxons a ring round the neck was a sign of servitude. It is a matter of doubt whether this was not the origin of the use of a ring in betrothal and marriage. Much superstition has collected round the use of rings. The practice of engraving mottoes or "posies" in rings prevailed in the 16th century, and has been revived in the "Mizpah" rings of our own time, while mourning rings are still occasionally given as memorials of the dead. The presentation, on certain occasions, of rings once prevailed in our Inns of Court.

Ring-Dove. [PIGEON.]

Ringed Snake (*Tropidonotus natrix*), the common snake of Britain, very often found near water, whence it is sometimes called the water snake. The upper parts are brownish-grey, marked with black; there is some yellow on the head, and the under parts are lead-blue, sometimes marked with black. These snakes, which are quite harmless, feed on frogs, small fish, lizards, birds and their eggs, and mice.

Ring-Ousel (*Turdus torquatus*), a well-known bird of the Thrush family, rather larger than a blackbird, from which it differs in its black bill and its white gorget. It is a native of Western Europe, visiting Britain in the spring, remaining to breed, and generally leaving in the autumn. The nest is usually made in heathy banks, and two broods are sometimes reared. It feeds on insects, worms, molluscs, berries, and fruit.

Ringworm, a skin disease, due to the growth of a fungus known as the *Trichophyton tonsurans*. Ringworm frequently affects the scalp in children, causing loss of hair in patches, with the formation of circumscribed areas in which broken-off stumps of hair are left like stalks in a stubble-field. Ringworm sometimes occurs in adult males, affecting the hairy parts of the face, and is then known as sycosis. Ringworm also at times affects the body, producing raised patches, with a reddened and elevated margin. The treatment of ringworm consists in destroying the parasitic fungus by which the disease is caused. The affected surface must be kept closely-shaven, scrupulously clean, and to it must be applied some

form of parasiticide, such as pitch-ointment or oil of cade. In the case of ringworm affecting the body, iodine is often applied.

Rio de Janeiro, the capital of Brazil and the largest city of South America, is to the west of the bay of that name on the east coast of Brazil, and presents a beautiful aspect from the sea, one of the first objects seen being the Sugar Loaf, which rises direct from the water to the height of 1,000 feet. To the north the bay, studded with islands, narrows to one mile in width. Beyond this, on the west, is the city, built partly on an island and partly on the mainland, and well-protected by forts. The old part of the town is on flat land, but a newer part is on the slopes of the hills which rise above the town and are interspersed with valleys. To the north well-timbered and cultivated ground rises to the Organ Mountains. The houses are of granite, with upper storeys of wood, and tiled roofs. The streets are for the most part paved, and have raised side-walks. The Campo de Sta. Anna is on the west, and beyond that, and joined by a bridge crossing an arm of the sea, is the new town. There is a Senate House, a town-hall, and some good churches and convents, the Imperial College, Library, Botanical Gardens, etc. One of the finest features of the town is the aqueduct, which, supported on a double row of 42 fine arches, brings water to the town from Mount Corcovado in the south-east. The noble roadstead—deep, extensive, and well-sheltered—is one of the finest in the world, but the wharf accommodation is poor. There are no important manufactures, but the export and import trade is large, the former consisting of coffee and other produce from the interior. Rio was settled by French Protestants in 1555, but in 1567 the Portuguese obtained it and founded a city which they called St. Sebastian. Until 1808 Bahia was the capital of the country.

Rio Grande, which merely means "Great River," is a name possessed by several rivers in America, one of the most notable being that which rises in the San Juan Mountains, flows south-west through Colorado, then south-east separating Mexico from Texas, falling into the Gulf of Mexico after a course of 1,800 miles.

Rio Grande do Norte is a maritime province of Brazil, having the Atlantic on the N. and E., Parahyba on the S., Ceara on the W., and containing 22,000 square miles. Mountainous in S. and W., the land descends N. and E. to a flat sandy coast. The coast is dangerous on account of its shoals, and there are no important rivers. The chief productions are cotton, sugar-cane, and manioc, and many cattle and horses are reared. The country also produces resin, gums, balsam, and dye-woods, and among the minerals are gold, silver, iron, salt, crystal, sandstone, limestone, and granite.

Rio Grande do Sul, a southern maritime province of Brazil, largely settled by Germans, lies to the E. and N. of Uruguay and La Plata, and contains 91,000 square miles. Along the coast are lakes, the chief of which are Lake Patos and Lake Mirim. The rivers of the S.E.

flow to Lake Mirim, those of the S.W. to the Parana and Uruguay.

Rio Negro, (1) rising in the south-east of Colombia, flows east into Venezuela, south into the Amazonas, and then east and south-east to the Marañon, with a course of 1,350 miles, in which it forms many lagoons. Its tributary, the Casiquiene, is the medium of communication between the Amazon and Orinoco. (2) A river of Argentina, has a course of 500 miles to the Atlantic, and is navigable for small vessels. It has great saline lakes.

Riot. When three or more persons associate together with intent mutually to assist one another against anyone who opposes them in the execution of some private enterprise with force or violence against the peace, or to the manifest terror of the people, whether the act intended were of itself lawful or unlawful, and although they depart of their own accord without doing anything, this is an unlawful assembly. If, after their first meeting, they move forwards toward the execution of their intended purpose, whether they actually execute that purpose or not, this is a rout, and if they put it into execution then it becomes a riot; and if any person encourages, promotes, or takes part in such riot, whether by words, signs, or gestures, or by wearing the badges or ensigns of the rioters, he is considered a rioter. The "Riot Damages Act, 1886," provides compensation to owners of property riotously injured, stolen, or destroyed out of the police rates of the district.

Rio Tinto, a river of southern Spain, is in the province of Huelva. Near its source are productive copper-mines, which are worked by a foreign syndicate, and employ 10,000 people. The metal is carried by railway to Huelva, near the mouth of the river and thence exported. The Romans worked these mines.

Ripon, a city in the West Riding of Yorkshire, on the left bank of the Ure, which is here crossed by a stone bridge of 14 arches, is 22 miles N.W. of York, and is on the North-Eastern Railway. Four principal streets lead to the market-place, which contains the town-hall and an obelisk, and is surrounded by good houses. The beautiful cruciform cathedral is 266 feet long, with a transept of 132 feet, and two square towers of 110 feet, and contains many monuments. Other buildings are Trinity church, the grammar school, infirmary, etc. The chief manufactures are machinery, saddletrees, leather, and varnish. Studley Royal and Fountains Abbey are in the neighbourhood.

Ripple-Mark, an undulation of the surface of sand or other fine-grained rock produced either directly by the action of the wind upon the surface when wet, or indirectly by its action on shallow water. In either case the rippling consists of alternating long slopes to windward and short steep slopes to leeward. If slightly sun-baked between tides, a fresh layer of sediment may preserve a ripple-mark, and we find hundreds of feet of sandstones thus rippled throughout and evidencing steady subsidence keeping pace with

deposition. When *in situ* ripple-marked beds tell us the direction of the wind when they were laid down. The under-surface of the next layer will present a cast which has been termed a *negative* ripple-mark. Ripple-marks are often associated with sun-cracks, rain-prints, and foot-prints, all signs of shore conditions.

Ristori, ADELAIDE (b. 1821), tragic actress, is the daughter of two strolling Italian players, and made her first appearance on the stage, it is said, at the age of two *months*. Her regular *début* occurred in 1835, and she made a great reputation as a tragic queen. In 1847 she married an Italian marquis, and retired from the profession for awhile, but, returning, played with notable success in all the European capitals, her impersonation of Lady Macbeth being considered superb.

Ritschl, FRIEDRICH WILHELM (1806-76), philologist, was born in Thuringia, and educated at Erfurt and Wittenberg. He made a special study of classical philology, took his degree in 1829, and became a professor at Breslau in 1833. After a tour through Italy he received the appointment of professor of classical literature at Bonn, and between 1848-54 published what is considered his greatest work, his edition of Plautus, remarkable for its wealth of learning and acumen. In 1854 he was made chief librarian and director of the Art Museum and Museum of Antiquities, and in 1865 removed to Leipsic as professor of philology. He was eminent for his knowledge of Latin inscriptions, and his work on that subject (1862) is of great value. As a teacher, too, he was noteworthy, it being calculated that forty of his pupils became famous German *sarants*.

Ritualism, or the strict observance of ceremonies, has prevailed in all times and among all nations, though it is often applied only to the observance of religious rites. The "trooping of the colours" in London may be taken as an instance of military ritualism; but in modern times the word is often used to signify the great importance attached to ceremonial, as embodying certain doctrinal truths, by a section of the Anglican Church.

Rivers are large streams of water flowing over a portion of the earth's surface and discharging themselves into the sea, a lake, or other rivers. They generally have their source in springs, or from the melting of snow and ice on the summits of the highest mountains. The most rapid movement is at the surface, friction retarding the lower current. A velocity of 3 inches a second at the bottom of a river is sufficient to tear up fine clay, 6 inches a second moves fine sand, 12 inches a second fine gravel, and 3 feet a second stones as large as an egg. When a river is in flood its transporting power is very great. The material carried by it is deposited in the estuary at its mouth, and tends to form a delta (q.v.).

Rivers, ANTHONY, LORD WOODVILLE (1442-83), was brother of the queen of Edward IV. and guardian of the young Prince Edward. His position caused envy in other nobles, which was heightened

by his ambition. 'When the king died, Rivers made preparations to place the young prince on the throne, but was frustrated by Gloucester, who caused him to be executed, without trial, at Pontefract and usurped the throne under the title of Richard III. Rivers had been Governor of Calais and captain-general of the king's forces.

River-Terraces, terrace-like remains of its own gravels and other alluvium cut into and abandoned by a river as it narrows and deepens its channel, each marking the level of a former flood-plain. In Europe there are commonly three such terraces, known as the *high-level gravels*, the *middle terrace*, and the *low-level gravels*, the highest being the oldest. In Maine and elsewhere there are four, five, or even six or seven levels, as in the valley of the Connecticut, and the period to which they owe their formation, that immediately following the Glacial Period, has been termed the Terrace Period. Though there can be little doubt that the successive terraces indicate a shrinking of the volume of water in the rivers from the time when they were swollen with the melting snows of later Glacial times, they probably also indicate successive uplifts of the land, increasing the velocity, and consequently the scour, of the rivers, whilst raising their former flood-plains beyond reach of inundation.

Riviera, a name applied to the Mediterranean coast for some distance on each side of Genoa. The Riviera di Levante, to the east, reaches to Spezzia, and the Riviera di Ponente, to the west, as far as Nice. Other towns are Monaco, Vintimiglia, and Bordighera. A road, begun by the French, traverses it, as also does a railway.

Roach (*Leuciscus rutilus*), a British fish of the Carp family, common all over Europe north of the Alps. It is about a foot long, dull-green above and lighter below; the fins, excepting the dorsal, are red.

Roaring, a symptom of disease in the horse. It usually occurs in association with mischief involving the laryngeal muscles.

Roaring Forties, a name applied to that part of the Atlantic which lies between the degrees of 40 and 50 N. lat. The name has reference to the stormy weather which is encountered here by ships going between Europe and North America. The name is also applied by analogy to the corresponding region in the south latitude of the Pacific.

Robbery, the felonious and forcible taking from the person of another goods or money to any value by violence or putting him in fear. (1) The taking must be unlawful; (2) The value is immaterial; (3) It must be by force or previous putting in fear. The punishment prescribed by an Act of the present reign (24 & 25 Vict., c. 96) is penal servitude for fourteen years or not less than five years, or imprisonment with or without hard labour and solitary confinement not exceeding two years. And if the robbery be not effected or proved, but the offender be convicted of *an assault with intent to rob*, such assault is also felony, and imprisonment to the same extent may be awarded,

though in case of penal servitude the term is limited to five years.

Robbia, LUCA DELLA (1400-82), sculptor, was born at Florence, where he studied under Ser Giovanni, an eminent goldsmith. He abandoned the goldsmith's art, however, and turned to sculpture, and after working in bronze for some years, he perceived the advantages of terra-cotta, and introduced a new enamelled ware which now bears his name. The secret of its manufacture was confined to his family, and died out before the end of the 16th century. Robbia executed many works, of which excellent specimens may be seen in South Kensington Museum.

Robert I. [BRUCE.]

Robert II. (1316-90), King of Scotland and first of the Stuarts, being a son of Walter Stuart, who married Robert Bruce's daughter. He succeeded his uncle, David II., in 1371, having previously been regent while the king was imprisoned in England. He was leagued with France against England, but was a somewhat weak monarch, of whom nothing notable has been recorded.

Robert III., his eldest son, was born about 1340, and inherited his father's weakness, allowing his kingdom to drift anyhow for many years. The quarrels of his brother, the crafty Albany, and his fiery son David, distressed him greatly, and, listening to his brother, he caused his son to be starved to death in a castle in which he had been imprisoned. Robert died in 1416, and as his son James was a prisoner, Albany became sole regent.

Roberts, DAVID (1796-1864), painter, was the son of a poor shoemaker in Edinburgh, and began his career as a house-painter, after which he became known as a scene-painter. Stanfield the artist helped him on, and in 1824 he exhibited at the Society of British Artists and at the Royal Academy in 1826. He was made president of the former body in 1830, and nine years after was made A.R.A. In 1841 he became R.A. Somewhat early in his artistic career Roberts went to Spain and made sketches of great merit, and published a collection of them. After an extended tour in the East he produced (1842) the great work on *The Holy Land, Syria, Idumea, Arabia, Egypt, and Nubia*, embellished with his magnificent drawings. His architectural pictures are well-known, engravings of them being common, and he illustrated many books in a sumptuous manner.

Robertson, FREDERICK WILLIAM (1816-53), was born in London, and was intended by his father, an army captain, for the Church, though his own taste led him to prefer a military life. He was sent to Brasenose College, Oxford, and, graduating there, was ordained in 1840. He entered on his clerical career with characteristic fervour, his first curacy being at Winchester, but after a year's hard work he was obliged to go abroad to recruit his health. He was married on the Continent to a daughter of Sir G. W. Denys, and on his return became curate at Cheltenham, where he remained five years. During these years he read deeply, and

all his writings are strongly tinged by his studies in theology, of which he may be considered an original exponent. His preaching was most impressive, and he was almost worshipped for his beautiful character. He finally settled in Brighton, where his zealous labours hastened his early death. During his last years he suffered agonies of mind and body. His highly poetical *Sermons* are and have been very widely read. In 1865 the Rev. Stopford Brooke published his *Life and Letters*, which went through several editions.

Robertson, THOMAS WILLIAM (1829-71), dramatist, was the son of an actor, and went on the stage himself at first. The first piece of his which really attracted attention was his *David Garrick*, an adaptation from the French; but his earliest genuine success was *Society* (1865), which was speedily followed by *Ours* (1866), *Caste* (1867), *Play* (1868), *School* (1869), and *M.P.* (1870). *Caste* is his most popular piece, and *School* ran 381 nights on its first production. Robertson wrote many other minor pieces, and did much journalistic work as well.

Robertson, WILLIAM (1721-93), Scotch historian, was educated at Edinburgh, and entered the ministry, being presented with the living of Gladsmuir, in East Lothian, in 1743. He was known as an eloquent preacher, but devoted most of his time to the study of history, and in 1759 published his *History of Scotland*, which is a well-written work and one of the best of its kind. It ran through 14 editions during his life. He received several important appointments, including that of historiographer-royal, in 1764. He was not, perhaps, so zealous in the cause of religion as might be expected, and was on intimate terms with some notable sceptics. His other important works are his *History of Charles V.* (1769), and his *History of America* (1777).

Robespierre, MAXIMILIAN (1758-94), revolutionist, was born at Arras, in the north of France, was educated at Paris, and, like his father and grandfather before him, became a barrister. He was a very ambitious and vain man, and the dawn of the Revolution found him amongst its strongest supporters. He saw his opportunity, and made the most of it; but for a long time, despite the rapid rise of even shallower men, he acted a merely subordinate part. By his violent speeches and uncompromising action, however, he attained popularity, and took his seat in the National Convention opened after the cruel massacres of September, 1792. The party known as "The Girondists" vehemently opposed his high-handed conduct, and very early proclaimed his dangerous character and tyrannical disposition. On one historic occasion he challenged them to declare his tyranny, and Louvet, one of their number, immediately replied with a startling philippic, which staggered even his effrontery. He was given a week to prepare his defence, and managed to get an acquittal. He in his turn denounced the Girondists, accusing them of sympathising with the unfortunate king, whom he savagely attacked. The Girondists weakly

relaxed their good efforts, seeing that the inflamed mob was with Robespierre, and the king was executed in January, 1793. Having glutted the popular thirst for the moment, Robespierre became almost supreme, and was hailed as incorruptible. As head of the Committee of Public Safety, as it was called, he exercised his power without restriction, aided by Couthon and St. Just. Marie Antoinette was executed in October, 1793, and the leading Girondists were the next victims, though it must be admitted that Robespierre also sent some of his most savage followers to the scaffold. The worship of Reason was established in June, 1794, and on July 28th of the same year the arch-tyrant himself was guillotined, owing to the efforts of the friends of the Gironde. He presented a fearful spectacle, as his jaw was smashed by a bullet, an injury either self-inflicted or at the hands of a gendarme. His sister lived until 1834.

Robin, REDBREAST, or ROBIN REDBREAST (*Erythacus rubecula*), a well-known bird of the Warbler family, resident in Britain, breeding as far north as the Orkneys. It is found nearly all over Europe, in North-West Africa, and the neighbouring islands, and in winter migrates as far south as the Sahara and eastward to Persia. It is rather less than six inches long, olive-brown above, reddish-orange on the breast, and greyish on the under parts. Robins are pugnacious in disposition, and solitary in habit. They feed on insects, worms, and fruit, and in severe weather, when the supply fails, they fearlessly approach houses in search of scraps and crumbs. Many folk-tales are current as to the origin of the ruddy plumage on the breast.

Robin Hood, an outlaw immortalised in English song and story, is supposed to have lived in the reign of Richard I., Sherwood Forest, Nottinghamshire, being the scene of his chief exploits. The greatest doubt hangs over the story, and he is believed by the best antiquaries to have been a purely mythical character. A tombstone, which used to be at Kirklees, Yorkshire, was said to be his, and it records his death as having taken place in 1247, but it is now known to be a clumsy imposture. Tradition states that he was the rightful Earl of Huntingdon, and that his name was Robert Fitzooth; that he never plundered any but the rich, and gave the proceeds to the poor in most instances. He was famous in Scotland, and one Scottish historian terms him "the prince of thieves" and "the most gentle thief." His skill as an archer, and the frolics of his companions, Little John, Friar Tuck, and Maid Marian, are the theme of many a ballad and song. A collection of these was made by the antiquarian Ritson, and some will be found in the *Percy Reliques*.

Robinson, HENRY CRABB (1775-1867), author of one of the most interesting volumes of reminiscences ever published, was born at Bury St. Edmunds, was educated at Devizes, and entered a lawyer's office. He became *Times* correspondent in Germany and Spain, and in the former country made the acquaintance of Goethe, Schiller, and other great men. He was called to the bar in 1813, and retired from practice in 1828. He moved in the

best literary society in England, and knew Coleridge, Lamb, De Quincey, Blake, Moore, Wordsworth, Shelley, Hazlitt, and many others, of whom he has left very valuable descriptions in his *Diary, Reminiscences, and Correspondence*.

Rob Roy (1671-1734), notorious Scotch free-booter, was the son of Donald McGregor of Glen-gyle, his mother being a Campbell. The Scotch Parliament had, in 1662, outlawed the McGregors and Rob Roy adopted the name of Campbell. He became a cattle-trader, and when the Pretender went into the field in 1715 joined his forces. At the close of the rebellion, the Duke of Montrose, with whom he had come into collision, confiscated his lands, and henceforward Rob Roy avenged himself as best he could by raiding. Scott's well-known novel of *Rob Roy* perpetuates the traditions surrounding the name.

Roc, a fabulous bird of huge size and immense strength mentioned particularly in the story of Sindbad in the *Arabian Nights*. The Crusaders seem to have brought the idea, with some embellishments, from the East. The bird was said to be strong enough to raise an elephant in its talons, and the idea may have had its origin in some tradition of an antediluvian beast.

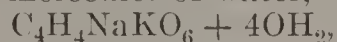
Rochdale, parliamentary borough (one member) and market-town of Lancashire, ten miles N.E. of Manchester, on the Roch, crossed by a bridge of five arches, the Rochdale Canal, the Calder and Hebble Navigation, and the Lancashire and Yorkshire Railways. The old town is irregular, but there are good modern streets. The parish church, on a height and approached by 122 steps, is Norman and Perpendicular of the 12th century, and has a square tower. There is a town hall, with grounds; a public hall, and a library. The Flemings brought the woollen manufacture here in Edward III.'s time, and much baize, flannel, and blankets are manufactured, as well as calicoes. There are also cotton-mills, foundries, machine-making, quarries, and collieries. Co-operative stores originated here.

Rochefort-Lucay, HENRI, MARQUIS DE (b. 1830), a French revolutionist of noble birth, began life as a journalist, and has a reputation as a brilliant writer, a collection of his articles being published in 1868. He started *La Lanterne*, was imprisoned and fined, became a deputy, fought many duels, and was deported to New Caledonia in 1871 as a convict for his share in the Commune. He escaped in 1874, was amnestied, and returned to Paris, but after the Boulanger episode settled in London, whence he now conducts the Paris *Intransigent*.

Rochelle, a French town and seaport, on the Atlantic at the extremity of the bay which forms the roadstead, is the capital of Charente-Inférieure, and 95 miles N.W. of Bordeaux. In front are the isles of Rhé and Oléron. The town is well built and fortified. The most notable features are the Porte de l'Horloge, the cathedral, the Hôtel de Ville, and the Palais de Justice. Ship-building, and the manufacture of cotton, glass, stoneware,

and sugar are the principal industries. The harbour is large and safe, and consists of an outer tidal basin and inner wet dock, capable of taking ships of 500 tons. The quay is planted with trees. Brandy, wine, wood, coal, salt, dairy produce, and oil are the chief objects of trade. Rochelle was a Protestant stronghold after the Reformation.

Rochelle Salt consists of the double sodium and potassium salt of tartaric acid. It is prepared by adding cream of tartar (acid potassium tartrate) to a hot solution of carbonate of soda. It crystallises with four molecules of water,



and forms prisms of the Rhombic system. It is readily soluble in water, and is used commonly both in the chemical laboratory and in medicine.

Roches Moutonnées, rounded hummocks of live rock left exposed above the turf on slopes that have been formerly traversed by a glacier. Their rounded polished surfaces have not retained soil or seeds, so that they stand bare and conspicuous, like black sheep on the hillside, whence their name.

Rochester. 1. A city, parliamentary borough (one member), and port on the Medway, and adjoining Chatham, is 29 miles S.E. of London. Rochester proper is on the right bank of the river, and a bridge connects it with Stroud. Rochester itself is enclosed on three sides by the river, and consists of one broad street, leading S.S.E. to Chatham, and contains some old houses. The cathedral, begun 604, is varied in style, and has a Norman west front and Early English crypt. The fine old castle keep, 70 feet broad and 104 feet high, forms a striking feature. Near it are pleasant recreation grounds. The grammar school, town hall, and dock-house are worthy of notice. Ship-building is an important industry, and there is a good trade in coal and oysters. Charles Dickens has identified himself with Rochester, and it enters into many of his books.

2. The capital of Monroe county, New York, on the Genesec, seven miles from Lake Ontario, has some important manufactures, which are aided by the water-power given by 268 feet of fall. There is a great cataract of 96 feet fall. The Erie Canal is carried over the river by an aqueduct, and the New York Central Railway passes through the town.

Rochester, JOHN WILMOT, 2ND EARL OF (1647-80), poet, was born in Oxfordshire, and in early life distinguished himself in the army. His father died in 1659, and on succeeding to the title he became a boon companion of Charles II., and was considered the most profligate of all that king's associates. He told Bishop Burnet that he had been intoxicated for four years without break. His early death was the result of this dissoluteness, but he became extremely repentant at the end. His poems, which are sometimes very witty, were collected and published in 1680. He had ordered them to be destroyed, on account of their licentious character, but his wishes were not carried out.

Rochet, a close-fitting surplice of lawn or lace now worn by bishops, and formerly by bishops,

abbots, canons, and other ecclesiastical dignitaries. Scott in *Woodstock* speaks of a "red rochet" as worn by a layman.

Rockets are probably of all the forms of fire-works the most popular and beautiful. In the details of their construction they may vary, but are all alike in their general form. They consist of a body, usually of stiff paper, which contains the composition to be fired. As this body is only open to the air by a small aperture below, the rapid out-rush of the gases produced by the firing causes the rocket to rapidly ascend, leaving behind it the stream of sparks, etc. When the composition has burnt out, touch-paper ignited carries the combustion to the head of the rocket, usually conical, made of paper, and containing a quantity of fireworks, which are thus ignited and scattered as brilliant and fiery rain, etc. Besides their use for firework displays, rockets are largely employed in signalling in war, at sea, and for life-saving apparatus. By far the greater quantity of rockets manufactured are indeed used for this purpose. The firework head is in this case omitted; otherwise their form is essentially similar. The rocket is attached to a rope and is fired from the land over the masts or rigging of the wrecked ship, and this rope then affords the means of fixing between the vessel and the shore a thicker rope, and the basket, "breeches buoy," etc., by which the sailors can be brought to land.

Rockgabbro. [GABBRO.]

Rockingham, CHARLES WATSON WENTWORTH, 2ND MARQUIS OF (1730-82), succeeded his father in 1750 and entered the House of Lords, where he obtained the reputation of being a wise and moderate statesman. Attaching himself to the Whig party, he became First Lord of the Treasury in 1765, after Pitt's refusal to accept the office. His Government was not a very brilliant one, and his introduction of Burke into Parliament is his most notable service. He was above all an honest statesman, and strongly objected to the action which led to the loss of the American colonies, thereby earning the hatred of George III. In 1782 he was again Prime Minister, but died three months after his accession to power.

Rockling, any fish of the genus *Motella*, of the Cod family; widely distributed. They are of small size, and chiefly distinguished by the number of their barbules. Five species are British.

Rock-Oil. [PETROLEUM.]

Rocks are solids occurring in considerable masses in the earth's crust. They exhibit great variety in chemical and mineral composition, in texture, and in general structure, which suggest differences in their mode of origin. Some rocks are almost exclusively composed of silica, silicates, and a few other substances that would withstand a very high temperature without volatilisation or even fusion; whilst others are largely carbonaceous or calcareous and, therefore, would readily be destroyed by heat. Some rocks again are made up of irregular, broken or rounded fragments, others of crystals, and others of glass or of crystals in a

glassy *magma* or ground-mass. Those of crystalline texture may be composed of one mineral, or of several, and in the latter case the minerals may be confused together or arranged in alternating layers (*foliated*). In general structure rocks may be *stratified*, or arranged in *strata*, or layers, or *massive*, or unstratified; and these last may occur thrust through others in branching *veins*, in wall-like *dykes*, in broad horizontal *sheets*, in rounded *bosses*, or in huge mushroom-shaped masses or *laccolites*. The primary divisions of the classification of rocks most generally employed are based upon their mode of origin as inferred from composition, texture, structure, and mode of occurrence. As the chief groups and individual species of rocks are noticed separately, it will suffice here to give a tabular grouping that will be self-explanatory:—

AQUEOUS ROCKS.

MECHANICALLY FORMED.

Psammitic (mainly siliceous):—

<i>Loosely aggregated.</i>	<i>Compact.</i>
Gravel.	Breccia.
Shingle.	Conglomerate.
Grit.	Gritstone.
Sand.	Sandstone.
	Greywacke.

Pelitic (mainly argillaceous):—

Clays.	Loess.
Mudstone.	Loam.
Shale.	Marl.
Fuller's-earth.	Marlstone.

ORGANICALLY FORMED.

Calcareous (mostly animal):—

Limestones.
Chalk.
Shell-marl.

Phosphatic (animal):—

Bone-beds.
Nodular or coprolite beds.

Siliceous:—

Flint.
Chert.
Tripoli.

Carbonaceous:—

Peat.	Coals.
Lignite.	Anthracite.
Jet.	Bitumens, oil-shales, and asphalts.

CHEMICALLY FORMED.

Calcareous:—

Stalactite and Stalagmite.
Travertine.
Oolite and Pisolite.
Cement-stone.
Dolomite (compact).

Gypsum.

Rock-salt.

Ferruginous:—

Hæmatite.
Bog-iron-ore.
Clay-ironstone.
Geyserite.

VOLCANICALLY FORMED.

Tuff.

IGNEOUS ROCKS.

Acid:—

<i>Crystalline</i>	<i>Glassy.</i>
Granite.	Obsidian.
Eurite.	Pitchstone.
Felsite.	Perlite.
Liparite.	Pumice.

Intermediate:—

Plutonic.
Syenite.
Diorite.

Volcanic.
Trachyte.
Andesite.
Phonolite.

Basic:—

Basalts.
Diabase.
Gabbro.

Ultra-basic:—

Peridotites.

METAMORPHIC ROCKS.

Slate.
Schists.
Gneiss.
Amphibolites.
Quartzite.

Saccharoid Marbles.
Dolomite (cavernous).
Opficalcite.
Serpentine.
Graphite.

Rock-Salt, the mineral form of common salt (NaCl), crystallises in cubes, often hollow, varies greatly in colour from slight impurities, being most commonly ochreous, and has a hardness of 2 to 2.5 and a specific gravity a little over 2. It is, of course, soluble, with a characteristically saline taste. It occurs as a volcanic sublimate and as an efflorescence in rainless regions of Africa and Chili; but chiefly in beds associated with gypsum, as the result of the evaporation of inland waters, as at Wieliczka in Austrian Galicia and in the Triassic rocks of Droitwich in Worcestershire, Middlesbrough in Yorkshire, and various parts of Cheshire.

Rock-Slaters, a group of Isopoda (q.v.) belonging to the genus *Ligia* and abundant in rock-pools around the English coast.

Rocky Mountains, THE, is the name sometimes applied to the mountains of the western half of North America, but strictly denotes the E. border of the region, extending from New Mexico to the Arctic Sea, and ending W. of the Mackenzie river. In Wyoming a region of elevated plateaus divides the range into two parts. The chief groups of the southern portion form the Colorado Range, rising to a height of 9,000 feet in Wyoming and crossed at a height of 8,000 feet by the Union Pacific Railway. In Colorado the height is 13,000 feet, rising in Gray's Peak to 14,341, Long's Peak 14,271, Pike's Peak 14,147. The Sawatch Range S. of Arkansas river has Mount Harvard (14,375 feet), with passes at a height of from 12,000 to 13,000 feet. The Parks of Colorado, North, Middle, South, and that of St. Luis, are from 6,000 to 10,000 feet, and surrounded by ranges three or four thousand feet higher. On the W. border of St. Luis Park is San Juan Range, with several peaks over 14,000 feet high, and very many more over 13,000 feet. The Sangre di Cristo Range to the N.E. of the Park has Blanca Peak (14,464), the Uintah Range, W. of the Park, has several over 13,000, and the Wahsatch Range, which is the W. limit of the Southern Rocky Mountains, rises to 12,000 feet E. of Salt Lake City. The northern division is less lofty and imposing except in the Yellowstone region (q.v.) and the Windrush Range. In Idaho and Montana greater irregularity occurs, and the Bitter Root Mountains forming the divide between the Columbia and Missouri have a height

of 9,000 feet, with passes ranging from 5,000 to 6,000 feet. The North Pacific Railway crosses at 5,548 feet with a tunnel over 1,000 yards long. The Crazy Mountains N. of the Yellowstone rise to 11,000 feet, and Mount Harvey in the Black Hills is 9,700. In Canada Mount Brown is 16,000 feet, and Mount Hooker 15,650, while the general height ranges to 14,000 feet. Athabasca Portage between these peaks crosses at a height of 7,300 feet. Of the rivers rising in the system the Mackenzie flows to the Arctic Sea, the Saskatchewan to Hudson's Bay, the St. Lawrence and Missouri to the Atlantic, the Colorado and Columbia to the Pacific. The scenery of the Rocky Mountains is of savage grandeur, the wild animals are plentiful and formidable, the forest growth in parts is magnificent, and there is great mineral wealth.

Rocky Mountain Goat (*Haplocerus montanus*), or MAZAMA, an aberrant American antelope, now confined to the north of California. The long hair is yellowish-white, and in general appearance it is not unlike a diminutive albino bison. The flesh is uneatable, from its strong musky smell, due to the musk-glands behind the horns.

Rocky Mountain Sheep (*Ovis montana*), an American wild sheep standing about 40 inches at the shoulder. The name is also given, erroneously, to the Rocky Mountain Goat (q.v.).

Rococo, a debased form of "Louis Quatorze" ornamentation, consisting of scroll-work of fantastic formation, without unity of design or purpose.

Rodents (*Rodentia* = "gnawing animals"), a well-defined order of Mammals, more widely distributed, and containing a greater number of species, than any other, and easily recognised by their large chisel-shaped incisor teeth and the absence of canines. All of them gnaw their food; nearly all are vegetable-feeders, but mice and rats are omnivorous. Most of them are adapted for life on the ground, but some are arboreal, others burrow, and a few are aquatic. There are two sub-orders—(1) Simple-toothed Rodents (*Simplicidentata*), with two upper incisors, and (2) Double-toothed Rodents (*Duplicidentata*), with a second pair of small size immediately behind the functional incisors of the upper jaw. Rats and mice belong to the first, and hares and rabbits to the second, group.

Roderic, the last Visigoth King of Spain, obtained the throne in the year 709, having managed to depose the King Witiza. His reign did not last long, however, for the two sons of the dethroned king, securing help from the Moorish governor of Africa, ravaged Andalusia, and finally met him in battle at Xeres, where Roderic, who was at the head of 90,000 Goths, was slain, and his army put to flight. Thus ended the Goth and commenced the Moorish dominion over Spain.

Rod-fishing, fishing with a rod and line, fly-fishing; it may be indulged in all the year round, though there are various close seasons for various kinds of fish.

Rodney, GEORGE BRYDGES, LORD (1718-82), noted admiral, born at Walton-on-Thames, and

son of a naval officer. He entered the navy at an early age, and in 1742 was appointed to the command of a ship, and did good service off the coast of Newfoundland, of which he was made governor in 1749. He returned home in 1753, and married the sister of the Earl of Northampton, and in 1759 became admiral of the blue. In the same year he bombarded Havre de Grace, and destroyed the stores which had been got together for the purpose of an invasion of England. About this time he made several important captures of the enemy. The record of his successes would fill some space; the most notable were the defeat of the Spaniards off Cape St. Vincent and the victory over the French fleet in 1780, for which he was thanked by the Houses of Parliament and granted £2,000 a year, and the decisive defeat of De Grasse and another French fleet in 1782, where he first introduced the practice of breaking the line of the enemy. He had been made a baronet after a long term of service in the West Indies, and at the close of his career was made a peer. He became M.P. for Saltash in 1752, and in 1768 was elected member for Northampton, but the expense was so ruinous that he was obliged to retreat to France for a time, the French trying to induce him to enter their service. He was buried in St. Paul's Cathedral.

Roe, ROE DEER (*Capreolus caprea*), a small deer, native in Europe and Western Asia, formerly common in Wales and on both sides the Scottish border, though few are now to be found south of Perthshire. The male stands a little over two feet at the withers, has a reddish-brown coat in summer, turning grey in winter, and antlers consisting of a rough bifurcated beam, the hinder branch of which is again forked, all the points being sharp and capable of inflicting a serious wound. Roe-Deer do not herd, a buck and roe with their fawns keeping together. They feed largely on the tender shoots of young trees, and do considerable damage to woods and plantations. The venison is less esteemed than that of the fallow deer, and the antlers are used for knife-handles, etc.

Roebuck, JOHN ARTHUR (1801-79), politician and reformer, was born at Madras, studied law, and was called to the bar in 1831. His father was in the Indian Civil Service, and his grandfather was a metallurgist of note. Some of Roebuck's early life was spent in Canada, but he came to England in 1824, and entered Parliament as an advanced Liberal. He sat first for Bath and then for Sheffield, and was a most active politician, causing the downfall of the Aberdeen Government in 1855 by his committee of inquiry into the state of the army before Sebastopol. His denunciation of trades unionism deprived him of much of his popularity, and latterly he voted with the Tories. He was made a Privy Councillor in 1879.

Roger (1096?-1154). King of Sicily, was of Norman origin, and was the son of Roger, Count of Sicily. In 1127 he claimed the duchy on the death of his kinsman Duke William of Apulia, who left no issue, and after some opposition had his claim allowed. Pope Honorius excommunicated him without effect, and did not recognise him till a

year had elapsed. In 1130 Roger gave himself the title of king, and was opposed this time by Innocent II., the successor of Honorius. He was, nevertheless, crowned in Palermo cathedral, and nine years later the Papacy acknowledged his sovereignty. He gained many victories, and made the name of Sicily known and feared in Greece and Africa, where he gained territory. He introduced silk manufacture into Sicily.

Rogers, JAMES E. THOROLD (1823-90), political economist, was educated at King's College School and at Oxford, and in 1862 became professor of political economy at Oxford, an office then held only for terms of five years. In 1868 he was defeated on seeking re-election, partly on political grounds. In 1874 he tried to enter Parliament, but without success, but was elected Liberal M.P. for Southwark in 1880, afterwards sitting for Bermondsey. He was defeated in 1886, and was reappointed to the professorship. He wrote two admirable works—*A History of Agriculture and Prices in England* (1866, etc.), and *Six Centuries of Work and Wages* (1884).

Rogers, SAMUEL (1763-1855), poet, was the son of a London banker, and was born at Newington Green. He entered his father's bank after receiving a good education, and published his first volume of poems in 1786. It was a crude effort, and was coldly received. In 1792 his *Pleasures of Memory* appeared, and at once gave him a wide poetical reputation. It was followed at intervals by *Human Life* (1819), *Italy* (1822), and other works, and upon the embellishment of these works by Turner and other artists he spent an immense sum—nearly £15,000. Rogers was well known in society, and on the death of his father in 1793 he took a house in St. James's Place, where all the greatest writers could be met at his famous breakfasts. He was very generous, though known for his caustic sayings. His collection of art-objects sold after his death for a large sum. His *Recollections* were published by his nephew.

Rohan, LOUIS, PRINCE DE (1734-1803), Cardinal Archbishop, and nephew of the Bishop of Strasburg, to whom he became coadjutor and successor. In 1772 he was sent as ambassador to Vienna, and there lent himself to such intrigues that the Empress of Austria refused to tolerate him. On his return to Paris he followed the same nefarious methods, endeavouring to obtain the favour of Marie Antoinette, but in vain. Though notoriously a profligate, he became Archbishop, Grand Almoner, and Cardinal. Marie Antoinette was induced to take part in a scheme to entrap him, which is famous in history as the affair of "The Diamond Necklace." He was told that the queen was not altogether indifferent to him, and he was advised to buy a diamond necklace for her. He did so, and was arrested, and after a year's delay was tried and acquitted. The queen, too late, saw the error of allowing herself to be drawn into the affair, and the scandal which occurred was the final incident leading to the Revolution. It may be said to have begun on the day of Rohan's release. Resigning his see, Rohan retired to Strasburg in 1801.

Rohillas, i.e. "Hillmen" (from *Roh*, "Hill," "Mountain"), a collective name often applied to the Afghâns of the Suleimân Mountains, but more especially to those who, during Mahmûd of Ghazni's invasions of India, settled in the district north of Oude now called Rohilkand. Here they became very powerful and a standing menace to the peace of the land till their strength was broken by the English at the battle of Kâbra in 1774. The account given by Macaulay of the British relations with the Rohillas (*Essay on Warren Hastings*) is not trustworthy.

Roland, MADAME (MARIE JEANNE PHILIPON), the celebrated victim of the French Revolution, was born in Paris in 1754, and was the daughter of an engraver. She was extremely fond of reading, and was especially delighted with Plutarch's *Lives*, which she always carried about with her. After the death of her mother she entered a convent for a year, and there pursued her reading without stint. She was as intellectual as she was beautiful, and in 1780 married M. Roland de la Platière, who was twenty-two years her senior. He was inspector-general of manufactures at Lyons, and was born in 1732. They travelled a good deal in Italy, Switzerland, and England between 1780-84. In 1791 M. Roland entered the Constituent Assembly as a deputy from Lyons, and most of his public acts were directly instigated by his courageous and brilliant wife. She welcomed the Revolution with effusion and accompanied her husband to Paris, taking part in the deliberations at the Jacobin Club and frequenting the sittings of the Assembly. She was one of the most eloquent women known to history, and she wielded a marked influence in the counsels of the Moderate party. M. Roland became acquainted with Robespierre and other leaders of the extreme party, but generally acted with the Girondists. When his office at Lyons was abolished he went to Paris in 1792 to claim his pension, and was appointed Minister of the Interior, though it was widely known that Madame Roland, who was devoted to him, would practically occupy the post. He was dismissed for sending a very outspoken letter to the king, which was really written by Madame Roland. Later she was arrested as a spy, but speedily released, and her husband was reinstated in his position as minister. He resigned, however, after the execution of Louis XVI., and, on the advice of his wife, fled when the Girondist party fell. She remained in Paris, and was at once arrested, and kept in prison for five months, during which time she wrote her *Memoirs*, a remarkably interesting work. On November 8th, 1793, she was led to the guillotine, bearing herself with great dignity and heroism. As she reached the statue of Liberty, she exclaimed: "O Liberty, what crimes are committed in thy name!" Her husband, whose whereabouts were not known, committed suicide when he heard of his wife's execution. Her *Memoirs* have been often republished, and her *Letters* have also been collected.

Roller, any bird of the Picarian family Coraciidæ, chiefly confined to the Ethiopian and

Oriental regions, and absent from the western hemisphere. The bill is long, broad at the base, and compressed towards the tip, and slightly hooked and notched. There are three genera, with nineteen species. The Common Roller (*C. garrula*) "spreads over the Palæarctic region as far north as Sweden and the Altai Mountains," and occasionally visits Britain. It is about a foot long, and the general plumage is blue, with a mantle of chestnut-brown. The name "Roller" refers to the habit of the male of turning somersaults in the air in the breeding season.

Rolling-mill, a combination of machinery used in the manufacture of malleable iron and the like. It consists of rollers placed either in pairs or in threes, one above the other. The heated iron passes between the rollers and receives a certain form according to the grooves in the rolls.

Rolls, MASTER OF, one of the Judges of the Court of Chancery, now the Chancery Division of the High Court of Justice, so named because he originally had the custody of all patents and grants which pass the Great Seal and also of the Records of Chancery. He was first called Master of the Rolls in the reign of Henry VII., but his office is as ancient as the old Court of Chancery itself. He now sits in the Court of Appeal only.

Roman Catholic Church. The Roman Catholic Church differs from all other Christian Churches in this, that it alone can show an unbroken historical continuity from the Apostolic age. The title "Catholic," indicating the claim of the Church to be universal, and not merely national, in its jurisdiction, occurs in the second century. The title "Roman," indicating the centre of the Church's unity, or the primacy of the Roman See, was foreshadowed by Irenæus (A.D. 202) when he declared that "with this Church (at Rome) every Church, that is, the faithful everywhere, must agree, because of its more powerful principality," and was common in the fifth and sixth centuries. In the course of ages the Catholic Church has undoubtedly undergone great changes in exposition of doctrine as well as organisation and ritual—changes which, by opponents, are described as corruptions, but, by the faithful, are upheld as legitimate and true developments of the original divine revelation. Heresies and schisms have arisen from time to time, either from certain bodies returning to a bygone doctrinal position or attempting to entirely reconstruct the constitution of the Church on the basis of Scripture, as was the case with the Protestant Churches of the sixteenth century; or by standing still while the Roman Church moved on, as in the recent case of Dr. Dollinger and the "Old Catholics," who refused to accept the doctrine of Papal Infallibility defined for the first time by the Vatican Council in 1870.

Roman Catholics maintain that the source of all doctrine is to be found in the Word of God, either written in the Bible or unwritten in traditions derived from Christ's oral teaching, and handed down by the Apostles. It is admitted that nothing can be added to this original deposit of faith; but

when doubts and controversies arise, the Church, claiming the assistance of the Holy Spirit, evolves, explains, or defines the full meaning of the revealed idea. These decisions have commonly been promulgated after discussion in Œcumenical Councils presided over or approved by the Roman Pontiff, successor of St. Peter, as head of the Church and Vicar of Christ. It was early recognised that a council of bishops could not define a doctrine in opposition to, or without the assent of, the Pope; and next it was argued that if the Pope, of himself, as supreme pastor, promulgated a doctrine *ex cathedrâ*, his teaching must be accepted as infallible, and did not need (as was maintained for some centuries by the Gallican Church) the consent of the bishops or of the Church dispersed. The inference led finally to the above-mentioned decree of the Vatican Council.

The Council of Trent, convened in opposition to the Protestant revolt of the sixteenth century, recapitulated and defined the traditional doctrine of the Church at that time, and reformed or revised the entire code of ecclesiastical discipline. A Catechism of the Council, or the Roman Catechism—an exposition of dogmatic and moral teaching, addressed to the parish priests—was prepared and issued by Papal authority. The Pope also, in 1564, published a "Profession of the Tridentine Faith," commonly called the Creed of Pope Pius IV.; and this creed, to which is now added a declaration of adherence to the decrees of the Vatican Council, is solemnly professed on certain occasions by the clergy, and by converts on their reconciliation to the Church. Another outcome of the Tridentine Council was an attempt to secure greater uniformity of usage and correct texts. The Latin Vulgate version of the Bible, declared "authentic;" the Missal containing the liturgy of the Mass, the central act of Catholic worship; and the Breviary, or divine office of psalms, lessons, hymns, and collects, either sung in choir or recited in private daily by all in holy orders, were subjected to a careful revision.

There are in communion with the Church of Rome, and acknowledging the supremacy of the Pope, several Churches in Eastern Europe and Asia which do not follow the Latin rite. These are the Greek, the Syriac, the Armenian, and the Coptic rites. The Greek rite has several subdivisions or forms, prevailing in various patriarchates or provinces, viz. the Greco-Roumanian, Greco-Ruthenian, Greco-Bulgarian, Greco-Melchite, and pure Greek. Some of these use for their liturgical language the ancient Slav and Arabic. The Syriac rite is divided into pure Syriac, Syro-Chaldaic, Syro-Maronite or Syro-Malabaric. The liturgical language of the Coptic rite in Egypt is Coptic or ancient Egyptian, and in Abyssinia the ancient Ethiopic or Geez language.

The Pope is assisted in the government of the Church by the College of Cardinals. The cardinals, styled Princes of the Church, were originally the priests and deacons in charge of the parishes of Rome and bishops of the suburban districts. It belongs to their office to elect the Pope, and they form his council or senate. When complete, the

Sacred College consists of 70 members. They occasionally meet in consistory under the presidency of the Pope; but the administration of the affairs of the Church in detail is carried on in Congregations, or committees of cardinals, under a Cardinal Prefect. These Congregations are now twenty in number. The chief are the Congregation of the Holy Office or Inquisition, instituted for the examination and repression of heresies and heretics; the Congregation of the Index, for the condemnation of writings injurious to faith or morals; the Congregation of Rites, which is concerned with all that relates to the liturgy, and has attached to it the important office of conducting the processes for the beatification and canonisation of saints; the Congregation of the Council, to which is reserved the settlement of all questions arising from the disciplinary decrees of the Council of Trent; the Congregation of Propaganda—*de propaganda fide*—which administers the affairs of missionaries in non-Catholic countries. Other Congregations are the Consistorial, Oriental Rite, Apostolic Visit, Bishops and Regulars, Residence of Bishops, Ecclesiastical Immunity, Discipline of Regulars, Indulgences and Sacred Relics, and Fabric of St. Peter's.

In February, 1893, there were 63 cardinals, 8 patriarchs of either rite, 799 archbishops and bishops of the Latin rite, residential, and 55 of the Oriental rite, 324 titular archbishops and bishops, and 19 with no title, making a total hierarchy of 1,268.

The Roman Catholic population of the world is estimated at over 200,000,000, that of Europe being 146,000,000. The number of Catholics in England and Wales is over 1,500,000; in Scotland, 365,000; and in Ireland, 3,547,307.

Roman Empire. [ROME (*History*)].

Romanesque, in architecture, is the style that prevailed in the early mediæval age from the 5th to the 12th century. The 1st period (5th to 11th) was a more or less debased form of Roman; but in the 2nd period (11th and 12th) it developed peculiarities of its own. The semi-circular arch and the massive masonry of Saxon and Norman architecture were borrowed from Romanesque.

Romanisch, or RUMANSCH, a Romance (Neo-Latin) language, formerly current throughout the Central and Eastern Alps of Switzerland and Tyrol, but now reduced by continued German and Italian encroachments to three enclosed groups: *Romansch proper*, spoken by about 40,000 in the canton of the Grisons, East Switzerland; *Ladin of Tyrol*, spoken by about 50,000 on the east bank of the Upper Adige; and *Ladin of Friuli*, spoken by about 200,000 in the Tagliamento basin, North-East Italy and thence to Goritz, in Austria. Total of Ladino-Romansch, or Rhaeto-Romance, speech, as it is also called, 290,000. The vocabulary is mainly Latin, while the phonetics and structure resemble those of Brescia, and other rude dialects of North Italy. Oldest monuments some Friuli inscriptions, dating from the 12th century; literature chiefly religious, with some national poetry and newspapers.

Romans, EPISTLE TO THE, was written by St. Paul, and is of doctrinal importance. Although it has been doubted whether the Epistle was of a piece, or a patchwork of different letters, it is now generally agreed that it is homogeneous. It is thought to have been written from Corinth about the year 58 A.D. The first part is doctrinal, and the latter deals with practical matters. Many commentaries upon it have been written, one of the best known English ones being Jowett's.

Rome, the mistress of the ancient world, the seat of the popes, and since 1871 the capital of the kingdom of Italy, is situated mainly on the left or E. bank of the Tiber, about 15 miles from its mouth. The river, which has here an average breadth of 200 ft., is spanned by 11 bridges in its course from N. to S. through the city, and about midway forms an island (Isola Tiberina, or di Bartolomeo). On the left bank rise the famous seven hills of ancient Rome, viz. (from S. to N.), the Aventine (150 ft.), Cœlian (165 ft.), Palatine (165 ft.), Capitoline (165 ft.), Esquiline (245 ft.), Viminal (175 ft.), and Quirinal (170 ft.); but mediæval and modern Rome is built chiefly on the plain (the ancient Campus Martius) nearer the river, and on the slopes of the Pincian Hill, to the N., extending thence to the E. to the Quirinal and Viminal. The smaller part of Rome on the right or W. bank includes the Borgo, to the N., with St. Peter's, the Vatican, and the Castello S. Angelo, and the Janiculan Hill, with Trastevere, to the S. The entire city is surrounded by a wall 14 miles in circuit, with 13 gates, the wall on the left bank being substantially identical with Aurelian's Wall, built in the third century; while the Leonine Wall (848 A.D.) round the Borgo was extended in the early 16th century. Very considerable modern improvements have been made since 1870. Wide new thoroughfares have been constructed, squalid, though picturesque, mediæval quarters, such as the Ghetto, have been swept away, and the Tiber has been embanked; but the too numerous blocks of ugly tenement-houses, due to the speculative builder, have added a modern feature that might well be spared. Rome abounds in open squares (piazzas) adorned with fountains, obelisks, or statues, the largest being the Piazza di S. Pietro, flanked by huge semi-circular Doric colonnades by Bernini, and one of the best-known being the Piazza di Spagna, the centre of the "Strangers' Quarter," with the Scala di Spagna, a flight of steps frequented by artists' models. The chief streets of modern Rome are the narrow Via del Corso, running N. from the centre of the business quarter to the handsome Piazza del Popolo, and the new Via Nazionale and the Corso Vittorio Emanuele, diverging respectively to the E. and W. from the S. end of the Corso.

The remains of ancient Rome have suffered severely from the vandalism and the neglect of past centuries, but they are now carefully preserved. The Forum Romanum, in some places nearly 40 ft. below the present street-level, has been in great part excavated, and the Via Sacra may be traced through it, passing the too scanty remains of the Colonnade of the Twelve Gods; the

temples of Vespasian, Concordia, Saturn (491 B.C.; eight columns standing), Castor and Pollux, and Faustina (now the church of S. Lorenzo in Miranda); the Arch of Septimius Severus; the Rostra, erected by Julius Cæsar; the Basilica Julia; the Column of Phocas (608 A.D.; the last-erected monument); the palace of the Vestal Virgins; the huge arches of the Basilica of Constantine, etc. The Arch of Titus (A.D. 70), with reliefs of the plunder of Jerusalem, stands on the Velia, the low hill between the Palatine and Esquiline. Beyond it are the enormous ruins of the Colosseum or Flavian Amphitheatre (A.D. 80), which could seat 87,000 spectators, and the Arch of Constantine (312 A.D.) at the beginning of the Via Triumphalis, which leads on to the Baths of Caracalla, the largest ruin in Rome, and the Circus Maximus (now occupied by the Jewish cemetery and the gas-works), in which 250,000 spectators found room. To the N.E. of the Forum lay the Fora of the Emperors, still in great part buried, except a portion of Trajan's Forum, the most magnificent of all, from which rises Trajan's Column (147 ft.), with its spiral band of reliefs of the Dacian campaigns. To the S. of the Forum rises the Palatine, the site of the primitive Roma Quadrata, now covered with the remains of the huge palaces, temples, and halls of the earlier emperors. Amongst the other ancient remains in Rome are the round Pantheon (now the Church of S. Maria Rotonda), with the tombs of Raphael and Victor Emmanuel; the Column of Marcus Aurelius (95 feet); the Castello S. Angelo or Mole of Hadrian, built by that emperor as his tomb, and now a fort; the Mausoleum of Augustus; the Baths of Diocletian (for 3,600 bathers); the Theatre of Marcellus; the Pyramid of Cestius; the Tomb of Cecilia Metella (on the Appian Way), etc. In the desolate and unhealthy Campagna outside the walls are seen the long lines of huge arches belonging to the immense aqueducts (some still used) that supplied the ancient city with water. Outside the walls also are the Catacombs, at first made for burial-places, but afterwards used by the early Christians for meetings and as refuges.

Ancient Rome contained about 300 temples, and modern Rome has about as many churches, 80 of which are dedicated to the Virgin. St. Peter's, St. John Lateran, S. Maria Maggiore on the top of the Esquiline, S. Paolo fuori le Mura ("outside the walls"), perhaps the most gorgeously-decorated church in Rome, and S. Lorenzo fuori le Mura are the five Patriarchal churches, to one or other of which all believers throughout the world are supposed to belong. With Santa Croce in Gerusalemme and S. Sebastiano, they make up the famous "Seven Churches of Rome" frequented by pilgrims. The six first-named, S. Agnese fuori le Mura, and S. Clemente (with its upper and lower church, resting in turn upon older pagan structures), are also known as the eight Basilican Churches. St. Peter's, adjoining the Vatican, perhaps the most famous and certainly the largest church in the world, has an area nearly twice that of St. Paul's in London, while its dome rises to the height of 403 feet. S. Giovanni in Laterano, adjoining the

papal palace of the Lateran (now a rich museum), claims to be the mother-church of all Christendom. Beside it are its ancient Baptistery and a building enclosing the Scala Santa, brought from Pilate's palace in Jerusalem in 326. Many of the Roman churches contain treasures of art or are interesting for their structure or history. S. Pudenziana, with fourth-century mosaics, claims to be the oldest church in Rome; S. Stefano Rotondo to be the largest round church in existence; S. Agostino (1479-83) to be the earliest domed church in Rome. S. Maria sopra Minerva is the only ancient Gothic church in the city. S. Pietro in Vincoli contains Michelangelo's famous statue of Moses; and S. Maria delle Pace Raphael's beautiful frescos of the Sibyls. The Gesù is the chief church of the Jesuits. San Carlo al Corso is the fashionable church.

The Vatican Palace, the residence of the pope, enjoys along with the Lateran the privilege of "exterritoriality." The massive building, said to include 11,000 apartments, contains the finest extant collection of ancient sculpture, with many celebrated statues, a rich gallery of paintings, a famous library, and other collections, besides the Sistine Chapel, adorned with frescos by Michelangelo and other masters, and the Stanze and Loggie, with paintings by Raphael and his contemporaries. The Quirinal Palace, another huge pile on the hill of that name, is occupied by the king. In the Piazza del Quirinale are two famous marble groups of Horse-Tamers. On the summit of the Capitol, approached by a flight of steps, are the Palazzo del Senatore (civic offices), the Palazzo dei Conservatori (antiques and paintings), and the Capitoline Museum (celebrated statues), forming three sides of the Piazza del Campidoglio, designed by Michelangelo, in the centre of which is an antique equestrian statue of Marcus Aurelius. A huge monument to Victor Emmanuel is being erected on the N. side of the Capitol. The numerous mediæval and Renaissance palaces of the Roman nobility, the Sapienza (university), the National Bank, various public offices, and the Protestant cemetery with the graves of Keats and Shelley, also deserve mention.

The art-collections of Rome, especially the collections of ancient art, are among the richest in the world. The priceless collections of the Vatican, the Capitol, and the Lateran, have been mentioned. Others are the national museum in the Baths of Diocletian for recently-discovered antiquities; the Museo Boncompagni (antiques); the Museo Kircheriano (antiques, ethnographical, and pre-historic); the Borghese gallery of paintings; the Barberini, Doria, Colonna, Torlonia, and Corsini galleries of paintings and antiques; the collections in the Mattei, Medici, and Wolkonsky Villas; the Villa Farnesina, etc. Rome has little commerce and no manufactures of importance. The papal and royal courts, the garrison, and the foreign visitors are its main sources of revenue. The population in 1891 was 407,936, or less than that of Naples.

History. According to the traditional account, Rome, "the Eternal City," was founded B.C. 753.



ROME.

A Capitulum. B Temple of Saturn. C Column of Phocus. D Temple of Vespasian. E Arch of Septimius Severus. F Forum. G Appian Way.

Alinari, Florence, phot.

Its early history, although containing certain undoubted facts, is so intermixed with legend that it is difficult to know at what point the authentic history of Rome commences, especially when it is remembered that almost all the public documents perished at the burning of the city by the Gauls (B.C. 390). It is not until a century later, the time of the war with Pyrrhus (B.C. 281), that full reliance can be placed upon the narrative. Rome was situated on the left bank of the Tiber, about 15 miles from its mouth; it was originally a Latin town, with certain Sabine and Etruscan elements in smaller proportion. It appears at first to have been an asylum for freebooters, but gradually, owing to its favourable position and the sturdy valour of its inhabitants, from a mere village became a town of considerable importance. Its government, according to tradition, was at first regal, and the names of seven kings are handed down to us. The tyranny of the last king caused a revolt, and the monarchical was replaced by a republican form of government, under two officers, called Consuls, who were elected annually; this arrangement, with slight intermission, continued in force until the establishment of the Empire, and nominally long afterwards.

Republican Rome. After the capture of Veii, one of the chief cities of Etruria (B.C. 396), Rome was taken and sacked by the Gauls (B.C. 390) but afterwards restored by Camillus. The long Samnite wars, which ended B.C. 290, insured to Rome the possession of nearly all Central and Southern Italy. Then, turning her attention outside Italy, Rome attacked Carthage, seized the west of Sicily, took Sardinia, conquered half of Gallia Cisalpina and part of Illyria. The second Punic War (B.C. 218-201), against the great general Hannibal, ended in the final triumph of Rome and the acquisition of West Sicily and Spain. Further conquests followed in Macedonia, Syria, and Galatia; in Gaul, Liguria, Spain, and Illyria; Greece was reduced to a Roman province, and Carthage and Corinth taken (B.C. 146). The guerilla chief Viriathus and the Spanish town of Numantia were subjugated, and a portion of Transalpine Gaul formed into a province. From this time Rome may be considered as the chief power in the world; but her old virtues had already commenced to deteriorate, and struggles, largely economic and agrarian in origin, began between the new nobility and the populace. The attempts of the Gracchi to improve the condition of things did not end the struggle. Several wars followed in quick succession, the Jugurthine and Servile Wars, wars against the Cimbri and Teutones, against the formidable Mithradates, and the Social War, arising from the claim of the Roman allies to the rights of Roman citizenship, and ending in their subjugation but admission. The conflict between Marius and Sulla created a reign of terror at Rome, in which hundreds were butchered, and resulted in an oligarchic reorganisation of the Constitution. After the death of Sulla the conflict between aristocrats and democrats commenced again; it was for awhile checked by the formation of the so-called First Triumvirate (Cæsar, Pompey, and Crassus), only to break out again between Cæsar and Pompey. By this time

the democratic programme initiated by the Gracchi had nearly all been carried or become antiquated, and the breakdown of the old constitution was manifest, especially in connection with provincial government. After the murder of Cæsar (March 15, B.C. 44), the conspirators, who had been unable to get power into their hands, were defeated at Philippi (B.C. 42) by the Second Triumvirate, Cæsar Octavianus, Marcus Antonius, and Marcus Lepidus. The last of the three being considered insignificant, the real struggle lay between Octavian and Antony. The battle of Actium (B.C. 31) decided the supremacy of the former, who was saluted by the Senate as Princeps, Augustus, and *Imperator*.

Imperial Rome. The period of Augustus's power was a time of peace and reorganisation. Few wars occurred, except such as were necessary to settle the natural boundaries of the Empire—the Rhine, Danube, Black Sea, Euphrates, Africa, and the Atlantic. The supreme power, although nominally shared with the Senate, was in reality in the hands of the emperor. His successors, Tiberius, Caligula, Claudius, and Nero, were hateful and cruel princes. The line of the Julian Dynasty ends with Nero. Then follow Galba, Otho, Vitellius; then three Flavian Emperors, Vespasian, Titus, Domitian. The wise and good Nerva, Trajan, Hadrian, Antoninus Pius, and Marcus Aurelius are followed by the unworthy son of the latter, Commodus. The brilliant conquests of Trajan in Macedonia and Dacia are succeeded by what may be called a period of military anarchy, during which the Prætorian Guard, who may be compared with the Janissaries of Constantinople, set up and deposed emperors at their pleasure. During this time barbarian inroads were frequent. Gibbon dates the commencement of the decline of the Empire from the reign of Commodus.

With the accession of Diocletian in 284 the Empire underwent reorganisation. In order to be able to resist the attacks of the barbarians more successfully, he created two Augustuses and two Cæsars of inferior authority. During the time of Constantine (306-337) Christianity triumphed over Paganism, and became the religion of the Empire. Shortly afterwards (330) the seat of empire was transferred to the city built by Constantine upon the Bosphorus, Byzantium, the modern Constantinople. Attacks of the barbarians again became frequent, and, although they were often repulsed, the Romans lost ground in Mesopotamia, Armenia, and Dacia, and the Goths gained a footing on Roman soil. After the death of Theodosius (395) the Empire was divided into two parts, an Eastern and a Western Empire. This was a fatal mistake, and materially hastened its downfall. Successful invasions of the barbarians followed in rapid succession—of Alaric in Italy; of the Alani, Suevi, Burgundians, Franks, and others in Africa, Spain, and Gaul, and of the Saxons in Great Britain. The provinces were abandoned in succession one after the other, and in 476 Romulus Augustulus, who, by the irony of fate, bore the names of the founder of the Empire and of the founder of the city, laid down the insignia of Empire before Odoacer, King of the Heruli, who claimed from the Emperor of the East sovereignty

of Italy, with the title of Imperial Regent. During this period Rome had been taken by Alaric, King of the West Goths, and by Genseric and the Vandals. The submission of Augustulus to Odoacer put an end to the Western Empire; the Eastern lasted nearly 1,000 years longer, until the taking of Constantinople by the Turks, 1453.

In 489 Theodoric, King of the Ostrogoths, overthrew Odoacer, founded a Gothic monarchy, and restored considerable prosperity to the state. On his death, in 526, in the reign of Justinian, the Byzantine troops drove the Ostrogoths from Italy, which was then governed for the Eastern Emperors by an exarch, Justinian's general Narses, who dwelt at Ravenna. In 568 the Lombards entered North Italy, founded a kingdom, and threatened the imperial power. As the exarch's influence weakened, the power of the Popes increased, chiefly owing to the rupture between the Eastern and Western Churches, which loosened the bonds between Italy and the Byzantine Empire. Under Leo III., the Iconoclast ("Image-breaker"), Rome and all the clergy arose against the exarch on account of a persecution directed against the worship of images, and about 730 formed an independent republic, governed by the Popes. Being threatened in turn by the Emperors of Constantinople and by the Lombards, Rome demanded aid from the Frankish kings. After the fall of the exarchate and of the kingdom of the Lombards, Rome for some time prospered under the protection of France, having been assisted by Pepin or Pippin, and by Karl the Great or Charlemagne, who was proclaimed emperor at Rome in 800, and the Western Empire was thus in a manner restored. Under Charlemagne's feeble successors the Italian nobles became practically independent sovereigns. On the breaking-up of the Karoling Empire in 887 Italy became a separate kingdom and the bone of contention between various Teutonic invaders; the land was ravaged by Norsemen and Magyars, and the power of the Papacy dwindled. At length, in 962, Otto the Great, King of the Germans, re-established order, put down the different factions, and was crowned emperor at Rome. From this time forth the sovereign of Italy was a German prince, whose authority varied from time to time. Disturbances, however, still continued, and the power of the Papacy increased, as did that of the great Italian cities, which were becoming independent republics. Henry III. forced Rome to submit to the Emperors, and appointed Popes of his own choice, instead of the office being at the disposal of certain families. In spite of this, however, the Popes soon found themselves obliged to defend the liberty of the Church and Italy against the Emperors, Rome and Milan being the chief centres of resistance. The Popes, while combating the domination of the Emperors, frequently found themselves attacked both by imperial troops and also by powerful families, by whom they were expelled from the city or forced to take refuge in flight. After three sieges Henry IV. took Rome, and drove out Hildebrand or Gregory VII. (1084). During the quarrels that arose during the time of Innocent II. (1140) Arnold of Brescia

established a republic and a senate at Rome, which lasted for nine years. Gregory IX. fled before Frederick II., who was marching upon the city. In 1281 the nobles, who were at the time masters of the city, refused to admit Pope Martin IV.; in 1309 Clement V., in order to secure the protection of France, changed the seat of the pontifical authority to Avignon; in 1347, taking advantage of the absence of the Popes, Rome again re-established the republic and senate. This state of things did not, however, long continue. In 1354 Cola Rienzi (q.v.), "the Last of the Tribunes," who meditated nothing less than the reunion of Italy in a single republic, with Rome as centre, having offended his supporters and the people generally, was massacred. The Popes did not immediately regain the mastery, and did not return until 1377. Even then, up to the 16th century, the great families, notably the Colonnese and Orsini, had more power. The Papal authority was finally consolidated by Alexander VI., Julius II., Leo X., and Clement VII. In the interval Rome had narrowly escaped being taken by assault by Charles VIII. when marching to the conquest of Naples (1495), and was actually captured by the Constable of Bourbon in 1527. When the rule of the Spaniards in Italy had at last re-established order, the position of Rome in the world became altered. Some of the Popes—notably Julius II., Leo X., and Sixtus V.—had materially beautified it, and from that time more than ever the city became the rendezvous of pilgrims, travellers, artists, and savants. At the end of the 18th century the tranquillity it enjoyed was interrupted by the French Revolution. Berthier deprived the Pope of Rome and proclaimed a republic (1798); the Peace of Longueville (1801) restored it to Pius VII., but in 1808 Napoleon reunited Rome and the greater part of the States of the Church (the rest being annexed to the kingdom of Italy) to the French Empire; he declared it the second city of the Empire, made it the capital of the department of the Tiber, gave it a French *préfet*, and styled his son King of Rome. The defeat and overthrow of Napoleon brought back the Popes, and reinstated them in authority until 1848, but in 1849 Rome became a republic. He was re-established by France in 1850, and French troops were kept in the city to defend him. After 1860 the Italians desired to make Rome the capital of a new kingdom, and by the convention of 1864, concluded with Napoleon III., the capital was fixed at Florence; but, after the reverses of France in the Franco-German War and the overthrow of Napoleon III., the king of Italy occupied Rome (October, 1870), which thus became the capital of the kingdom of Italy (q.v.).

Romilly, SIR SAMUEL (1757–1818), practised at the bar when quite young, and in 1790 issued a pamphlet on the French revolution. In 1806 he was made solicitor-general and knighted. He then devoted his attention to the amendment of the criminal law, and opposed vigorously slavery, the spy system, and the suspension of the Habeas Corpus Act. He committed suicide in 1818.



JOHN, LORD ROMILLY, (1802-73), his son, was born in London. He graduated at Cambridge and was called to the bar in 1827. Entering Parliament as member for Bridport in 1832, he became Solicitor-General and was knighted in 1848, and two years later was made Attorney-General. His appointment as Master of the Rolls was undoubtedly well deserved, and his services were rewarded by a peerage in 1866. He retired in 1873. He superintended the publication of the calendars of State papers.

Romney, GEORGE (1734-1802), painter, was born in Lancashire, and was apprenticed at the age of nineteen to a portrait-painter of Kendal. He made rapid progress in his art and in 1756 married. Soon after he developed his own style, and in 1762 came to London, where he obtained many commissions. He went to Italy for a couple of years, and on his return settled in Cavendish Square. He was recognised as a powerful rival of Reynolds and Gainsborough, and his portraits, of which he painted a great number, are highly valued. He also painted poetical subjects well. He never exhibited at the Royal Academy. A few years before his death he became imbecile. In the National Portrait Gallery are many of his works.

Romulus, mythical king of Rome, and its supposed founder, was, according to the legend, suckled with his brother Remus by a she-wolf and reared by a shepherd. They were said to be sons of Mars, and Romulus was taken up to heaven at his death and became the god Quirinus; 753 B.C. is given as the date of Rome's foundation.

Ronsard, PIERRE (1524-85), French poet, became Court page to King James of Scotland, when that monarch was in France, and accompanied him to Scotland, where he remained three years. On his return to France he entered the household of the Duc d'Orléans, who sent him on various missions abroad. Becoming deaf, he left the service of the Court and commenced to write verse, translating the *Plutus* of Aristophanes. In the reigns of Francis I. and Charles IX., who favoured him, he was a prominent figure in literary history, and must be acknowledged, if not a great poet, at least a great innovator in French poetry. His sonnets are especially admired.

Rood-Screen, a screen separating the choir of a church from the nave and supporting the rood or crucifix.

Rook (*Corvus frugilegus*), a well-known British bird of the Crow family, common in Europe and some parts of Asia. The adult male is about twenty inches long, with bluish-black plumage, with the forehead, cheeks, and throat bare, and black bill, legs, and feet. Albino and pied specimens occur. The rook is a social bird, forming large flocks, and nesting by preference near human dwellings, often in squares and gardens, in towns and cities. Rooks are chiefly insectivorous, and, though they do some damage to grass and young corn in their search for grubs, are probably to be reckoned among the farmer's friends. Migrants from the Continent arrive in Britain in the autumn, and there is a return in spring. Occasionally there

is "an extensive movement and an apparent immigration of rooks, about November, on the south-



ROOK.
(*Corvus frugilegus*.)

west coast of Ireland. The birds arrive from the west or south-west" (*Field*, March 10, 1894).

Root, the descending axis of the plant, growing towards the centre of gravity. Its functions are (1) to fix the plant, whether in soil, in water, by weighting it, as in the case of the duckweed, or on another plant, as in that of epiphytes and parasites; (2) to absorb liquid nutriment; and (3) in some cases, chiefly among biennials and perennials, to act as a reservoir of nutriment.

True roots only occur in plants above the grade of mosses, these latter and more lowly-organised plants having merely cellular *rhizoids*. Roots originate in deep-seated layers of tissue, and are, therefore, termed endogenous. Pushing and corroding their way through the more superficial tissues, they are generally surrounded at their base by a torn sheath, or *coleorhiza*, whilst their apex is protected by the *root-cap*, or *pileorhiza*, of dead cells, which have originated from the division of a special region of the dermatogen, known as the *calyptrogen*. Increase in length takes place by division of cells behind this cap. The epidermis is delicate, and without stomates. It may be absorbent, but is generally furnished with numerous unicellular *root-hairs*, which absorb liquid food, with gases dissolved in the same, by the process known as *osmose*.

Roots may exude acid solvent substances, and are without root-hairs when surrounded by the *mycorhiza*, or mycelium of certain fungi. Roots develop mostly in those directions in which moisture occurs, and thus drain the land while appearing to search for water; and two kinds of plants growing in the same soil exercise a selective power by which they take in different substances, and thus differ markedly in the proportions of their chemical constituents. Similarly, the same species grown year after year in any soil will impoverish it of certain substances, thus

necessitating manure, or a system of rotation of crops, or fallowing, to allow of natural regeneration of the soil.

Internally the root consists generally of a *stele*, or fibro-vascular axis, consisting of alternating bundles of xylem and phloëm, both centripetal in their development, surrounded by the *pericycle*, in which the lateral roots originate, and, in old roots, by a thick impermeable cortex. Roots do not as a rule bear leaves, and, with the exception of the aerial roots of epiphytes, are seldom green. In many cases they will grow equally well under diverse conditions, a young oak, a hyacinth, a willow, or an alder, growing equally well, for instance, in water or in soil, whilst some Himalayan rhododendrons, epiphytes in their moist native climate, in England grow well in soil.

Roots may be divided into three classes—primary, normal, or tap-roots; secondary or lateral; and adventitious. The *primary root* is developed directly from part of the embryo, and in its earliest stage is known as the *radicle*. In palms it only persists for four or five years; but in gymnosperms and dicotyledons it is commonly well developed, and, from its tapering form, is known as a tap-root. In nursery-gardens it is usual to cut off the tap-roots of apple, hawthorn, holly, oak, and other trees, to stimulate the formation of side-roots and facilitate transplanting. The *conical* root of the carrot and parsnip, the *fusiform* or spindle-shaped root of the radish, and the *napiform* root of the turnip are examples of tap-roots enlarged to serve as food-reservoirs.

Lateral, or *secondary roots*, spring from the primary root opposite the xylem bundles, and are consequently in a limited number of vertical rows (orthostichies) down the tap-root. They sometimes reach a great length, those of the ash extending over thirty yards from the stem. They may themselves branch repeatedly, as in the wallflower, until we have the so-called *fibrous roots*, which superficially resemble clusters of slender unbranched adventitious roots. Secondary roots occasionally bear necklace-like swellings, as in *Pelargonium triste*, when they are known as *moniliform*.

Adventitious roots are those that are borne in no definite order, springing from any part of the plant, as from the base of the embryo in monocotyledons, from bulbs and other underground stems, the nodes of trailing stems and runners, as in the ground-ivy and the strawberry, the climbing stems of ivy, or the bases of cuttings. They are generally clustered and unbranched, but may be fleshily enlarged, as in the *nodulose* root of the dropwort, *Spiræa Filipendula*, the *fasciculate* roots of *Dahlia*, and the *tuberculate* roots of our terrestrial orchids.

Rope is made for the most part of twisted hemp or other similar material. The old and tedious process of manufacturing by hand upon a rope-walk has been in great measure superseded by a machine invented by Captain Stoddart and since improved upon, the advantages of this process being an absolute uniformity of shape and a more equal tension of the component parts. From 16 to 25 yards of hemp form a strand, three strands a

hawser, four strands a shroud, and three shrouds or hawsers a cable. A rope is said to be *cable-laid* when it is composed of three large strands, each consisting of three smaller ones, and *hawser-laid* when composed of three strands. A stiff rope, without much capacity for bending, is made by twisting six strands around a seventh, which passes as an axis through the middle. Tarring a rope increases its power of resisting the action of water, but takes away from its strength. Manilla hemp makes a very strong rope. Other materials employed in rope-making are steel wire, with or without a hempen core, and cocoa-nut fibre, while in some places bark is used for the purpose.

Rope Gearing is a means of transmitting power between rotating shafts. It is similar to belt gearing, save that hemp (or occasionally cotton) ropes, an inch or more in diameter, are used instead of belts. As the rope rests in a **V** groove, it is jammed against the sides of the groove with considerable force, and is thus less liable to slip than a flat belt. Ropes of large diameter would not be flexible enough to bend round pulleys of reasonable size, so a number of separate ropes are used whose united strength is sufficient to transmit the requisite force. The grooved wheels and round leather or cat-gut bands used in sewing machines and lathes are simple forms of rope gear.

Rorqual, any whale of the genus *Balænoptera* found in almost all seas. The skin of the throat is closely folded, the dorsal is distinct, and the tail greatly compressed before it expands into flukes. Four species occur in British seas, the Blue Whale (*B. sibbaldi*), the largest living animal, may reach a length of 85 feet. These whales feed mainly on small crustaceans, though the Common Rorqual (*B. musculus*) preys upon herrings. Rorquals yield little blubber; their baleen is of inferior quality.

Rosa, SALVATOR (1615–73), great painter, was born near Naples, and studied under Francanzano and at Rome. His taste led him to paint landscapes of a peculiarly gloomy kind, and he treated Nature in her most terrible aspects in his pictures. He was exceedingly versatile, writing plays and composing cantatas, and was greatly patronised by the Duke of Tuscany. He did much work for churches, but chiefly devoted himself to landscape. Some fine specimens of his art are in the National Gallery.

Rosaceæ, a large order of calycifloral dicotyledons, including plants of all sizes and countries, agreeing in having polysymmetric and generally pentamerous flowers, with polypetalous, perigynous corolla, indefinite stamens, and exalbuminous seeds. The fruit is very varied, being either a drupe, an achene, an utricle of achenes or drupels, or a pome. In none of these are the carpels truly fused into a syncarpous fruit. There are ten tribes, sometimes treated as distinct orders:—(1) *Pomaceæ*, including apples, pears, quince, hawthorn, medlar, etc.; (2) *Roseæ*, including the roses; (3) *Poterieæ*, including burnets, ladies'-mantle, and agrimony; (4) *Rubee*, including the brambles and raspberries; (5) *Potentilleæ*, including strawberries and cinque-foils; (6) *Spiræeæ*, including meadowsweet, dropwort, and

China-rose ; (7) *Neuradaceæ* ; (8) *Amygdaleæ*, including almonds, peaches, cherries, plums, and apricots ; (9) *Chrysobalaneeæ* ; and (10) *Quillajeeæ*.

Rosaniline. A number of important dye-stuffs are known as rosanilines. They are all derivatives of rosaniline itself, which is a colourless crystalline substance of the composition $C_{20}H_{21}N_3O$. It acts, however, as a strong base, uniting with acids to form salts, which are usually metallic green, crystalline compounds, soluble in water, forming, even when very dilute, strongly-coloured solutions. As an example, *magenta* or *fuchsine* is the best known, and consists of the chloride of rosaniline. The salts are prepared commercially by treating *crude* aniline with an oxidising agent, a salt or acid being afterwards added. By substitution of hydrocarbon radicals for some of the hydrogens in the compound many other dyes are formed, *e.g.* Hoffmann's violet, methyl blue, aniline blue, night green.

Rosario, a town of Argentina, in the province of Santa Fé, on the right bank of the Paraná, 170 miles N.W. of Buenos Ayres. It is 60 feet above the river, and has greatly improved of late years with the development of the railway which passes through from Buenos Ayres to Tucuman. The river is navigable for large vessels, and there is regular steam communication with Buenos Ayres. The chief exports are wheat, maize, hides, skins, preserved meat, flour, timber, copper, and wool.

Rosary, a string of beads used for numbering the prayers offered at fixed times of the day.

Rosas, DON JUAN MANUEL IRTIZ DE (1793-1877), Argentine statesman and President of the Confederation, was born at Buenos Ayres, and was of noble descent. He was a Federalist, but supported President Rodriguez in 1820, and in 1831 was made captain-general, organising the Confederation and helping to subdue the Indian tribes. His unscrupulous methods procured him the position of president, and he then became absolute dictator, embroiling the state with England, France, and Brazil. He tried to force the Plate River States into the Confederation, but failed, and was in 1852 defeated at Monte Casiros. He escaped to England, where he died.

Roscius, QUINTUS (died 62 B.C.), famous Roman actor, whose name has become proverbial. He was a friend of Cicero, who defended him in one of his orations. Horace refers to his scholarly acting. He was a comic actor, and excelled in high comedy, making a large fortune on the stage. Garrick was named "The British Roscius," W. H. Betty "The Infant Roscius," and the name is perpetuated in Churchill's poem of *The Rosciad*.

Roscoe, WILLIAM (1753-1831), historian, was born in Liverpool, and became an attorney first and then a banker. He was an admirer of the French Revolution and an ardent advocate of the abolition of slavery, and entered Parliament as member for Liverpool in 1806. He took great interest in art, and numbered Reynolds, Fuseli, and other artists among his intimates. His best works are undoubtedly his very successful *Life of Lorenzo de Medici* (1796) and *Life and Pontificate of Leo. X.* (1805).

Roscommon, an inland Irish county, in the province of Connaught, having Sligo and Leitrim on the N., on the E. and S. Leitrim, Longford, Westmeath, King's County, and Galway, and on the W. Galway and Mayo. It is 60 miles long by 40 broad, and contains 607,691 acres. The surface is undulating or flat except in the N., where the Curlew and Braughlieve Mountains rise to 1,200 feet. The lower parts are fertile, and for minerals, coal and iron are worked to some extent, and limestone is quarried, while potter's clay and pipe-clay are found. Oats and potatoes are cultivated, and many cattle and sheep reared. The Shannon drains the county, and there are several lakes. The town of Roscommon, which is the capital, is a corporate market-town, 79 miles N.W. of Dublin, and has the ruins of a fine thirteenth-century castle and abbey.

Rose, a genus of shrubs, the type of the order Rosaceæ (q.v.), including about thirty species, natives of northern temperate regions, chiefly in the Old World, but extending into India, Abyssinia and Mexico, well known both in a wild and in a cultivated state for the beauty of its flowers. Most species bear prickles: the leaves are imparipinnate with stipules adhering to the leaf-stalk: there are normally five petals, which are some shade of red, yellow, or white, and indefinite stamens and carpels. The fruit is a globose or ovoid concave fleshy receptacle ("hip") containing the free carpels and crowned by the remains of the leafy sepals. Botanists have described several hundred species, including nearly twenty British ones, besides an immense number of varieties; but these can be greatly reduced. The best known British species are *Rosa spinosissima*, the burnet rose, *R. rubiginosa*, the sweet-briar, *R. canina*, the dog-rose, and *R. arvensis*, the white hedge-rose. Of the cultivated species the most important are the Cabbage or Provence rose, *R. centifolia*, the Damask rose, *R. damascena*, and *R. gallica*, from which attar of roses (q.v.) and rose-water are manufactured. The number of garden hybrids and varieties is infinite, and their beauty and fragrance have rendered them the favourites of the poets, by whom the rose is styled the Queen of Flowers. As political emblems, the red rose of Lancaster, the white rose of York, the Tudor rose of England, and in later times the white rose of the Jacobites, have played important parts.

Rosebery, ARCHIBALD PHILIP PRIMROSE, 5TH EARL OF (b. 1847), was born in London. Educated at Eton and Christ Church, Oxford, he entered the House of Lords in 1868, succeeding his grandfather, the fourth earl. He made his first speech in 1871, and, taking a great interest in social subjects, sat on several committees formed to investigate the condition of the people. In 1874 he was president at the Glasgow meeting of the Social Science Congress. In 1878 he became Lord Rector of Aberdeen University, and two years later of Edinburgh University. He married the daughter of Baron Rothschild in 1878, and in 1881 entered the Liberal Ministry as Under Secretary of the Home Department. In 1884 he became First Commissioner of Works, and

in 1886 was made Secretary for Foreign Affairs, a post he has held for the second time since the last change of Ministry. He resigned this in March, 1894, on succeeding Mr. Gladstone as Prime Minister. When the London County Council was established in 1888, he was elected a member, and became its first chairman. As an author, Lord Rosebery is chiefly known by his *Life of William Pitt*.

Rosemary, a corruption of the Latin name *Rosmarinus* ("sea dew"), applied to a genus of Labiatae (q.v.), containing only a single species, *R. officinalis*, from its glaucous surface. It is a native of Southern Europe, and has narrow revolute leaves, a purplish bilabiate calyx, pale blue corolla, and only two stamens. Its fragrant, slightly-stimulant character caused it to be formerly considered good for headache or failing memory. This is the meaning of Ophelia's "There's rosemary, that's for remembrance," in *Hamlet*, and of the use of the plant at funerals. It enters into the composition of Hungary water, eau-de-cologne, and other perfumes, and its essential oil renders it useful as a lotion in cases of baldness. It is largely produced in the island of Lesina, in Dalmatia, and exported from Trieste. One hundredweight of the flower-heads yields 24 oz. of oil. It is adulterated with turpentine.

Roses, WARS OF THE, were the civil wars which took place between the years 1455-85 to settle the rival claims of the Houses of York and Lancaster to the English throne, the former adopting the white rose, the latter the red, as their badge. It is computed that 12 princes of the blood, 200 nobles, and 100,000 commoners perished in these wars.

Rosewood, valuable furniture woods of a dark reddish colour, and of various origins. They are mostly the product of species of the leguminous genus *Dalbergia*. *D. nigra*, of Brazil, is the most esteemed, and *D. latifolia* and *D. sissoides* are the sources of Indian rosewood. Inferior sorts are obtained from the Jacaranda trees, species of *Macharium*, in Brazil. Burmese rosewood is that of *Pterocarpus indicus* (the "Padouk"), and African rosewood that of *P. erinaceus*. All are leguminous. We import three or four hundred tons annually in slabs about 12 feet long.

Rosmini, CARLO DE (1758-1827), Italian historian and biographer, was born in the Tyrol, and, being destined by his parents for the law, studied at Innsbruck, but on his return to his native place was induced to betake himself to literature, his moderate fortune enabling him to devote himself to a literary career without inquietude. In 1802 he went to Milan, where he remained till his death. He wrote a considerable number of works, all of which show erudition, accuracy, and impartiality, the most important of them being a *Life of Ovid* (1789), a *Life of Seneca* (1793), a *Life of Victorino da Feltrio* (1801), a *Life of Fr. Filelfo* (1808), a *Life of Gior. Gia. Trivulzio* (1815), and a *History of Milan*, in 4 vols. (1820). He was a member of the Florentine Academy, and exercised much influence on the literary movement of his time.

Ross, which also includes Cromarty, is a county of North Scotland, having Inverness, Beauly Firth, Moray Firth on the S., Dornoch Firth and Sutherland on the W., and including also the Isle of Lewis. The area is over 2,000,000 acres. The west coast is rugged and bold, and has many lochs, e.g. Alst, Carron, Ewe, Broom, Little Broom, Torridon, and Greinord, while on the east coast are Beauly Loch and Firth, Cromarty and Dornoch Firths. The peninsula called the Black Isle is very fertile, while in some parts are mountains and deep glens, the mean height of the mountains being 3,000 ft. In the W. is excellent pasture, and good cattle and sheep are reared. There are no great rivers, but there are five lakes, of which Loch Maree is 12 miles long and two broad. The county returns one member. The chief towns are Dingwall, Stornoway, and Cromarty.

Ross, SIR JOHN (1777-1856), arctic explorer, was born in Wigtonshire, and entered the navy while a boy. In 1818 he went on his first arctic expedition with Parry, and published his *Voyage of Discovery*. His *Narrative of a Second Voyage* came out in 1833, after his return from the expedition commanded by himself. He made some important discoveries, and was rewarded by a consular appointment. He searched for Franklin without result on his last voyage in 1850.

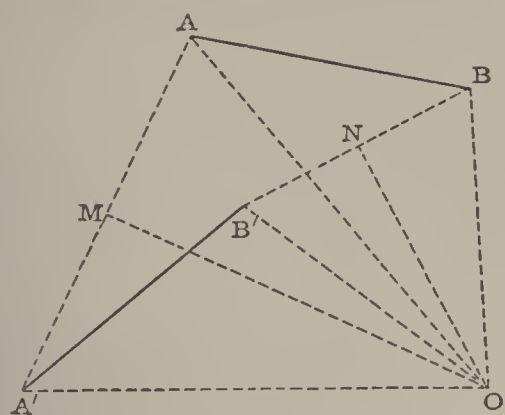
Rossetti, GABRIEL CHARLES DANTE (1828-82), poet and painter, was born in London, and was the son of an Italian exile and poet. He was first sent to a private school, and afterwards to King's College, where he remained from 1835 to 1843. He had written verse from a tender age, and his first poem was privately printed in 1843. Having a taste for art, he was sent to a school of design at Bloomsbury, and then to the Royal Academy. After studying under Ford Madox Brown for a time, he took a joint studio with Holman Hunt. In 1849 his first picture was exhibited, and about the same date the famous Pre-Raphaelite Brotherhood was founded by Rossetti and a group of gifted young artists. They had a periodical called *The Germ*, to which he largely contributed. In 1860 Rossetti married a Miss Siddall, who had sat for some of his wonderful portraits, and her death in 1862 greatly affected him. He buried his manuscript poems with her, but his friends afterwards induced him to exhume them. Previously, in 1861, he had published a volume of fine translations from the Italian. In 1870 his *Poems* appeared, and in 1881 his *Ballads and Sonnets*. He died at Westgate-on-Sea, and was buried at Birchington, his pictures being twice exhibited after his death. He has written some beautiful ballads, and certainly his magnificent sonnets are among the noblest in the language. His brother WILLIAM MICHAEL (b. 1829) is a well-known poet and critic, and his sister CHRISTINA (b. 1830) is also a remarkable poetess. Another sister, MARIA FRANCESCA, wrote *A Shadow of Dante*.

Rossini, GIOACCHINO (1792-1868), composer, was born near Bologna, and commenced his musical career as a chorister. His intense love of music led to his unremitting study of it, and he produced

at an early age some very creditable works. In 1813 he brought out his *Tancredi* at Venice, and this opera was received with tremendous enthusiasm. Three years later appeared in Rome his *Il Barbiere di Siviglia*, also a great success. In 1821 he married, and left Italy in 1823 to go to Paris and London. He became director of the Opera in Paris, but neglected his duties and lost the post. *Guillaume Tell* appeared in 1829, and was followed at intervals by his *Semiramide*, *Mosé in Egitto*, and *La Donna del Lago*. He returned to Italy in 1836 and settled in his native place, but left it finally in 1855 for Paris, where he died. Besides some admirable operas, he has left to posterity his beautiful *Stabat Mater*, so well known to music-lovers.

Rostock, a North German town in the Grand Duchy of Mecklenburg-Schwerin, in a flat district, on the left bank of the Warnow, a navigable river which forms an inland lake communicating with the Baltic, 59 miles N.E. of Lübeck. It consists of Old, New, and Middle Town, the first of which is irregularly built and the middle well built. Notable features are the Grand Duke's palace, the Stadthaus with its seven towers, the 14th-century church, and the university. The chief objects of industry are machinery, cotton, tobacco, paper, brewing, distilling, and ship-building. There is a great trade, especially with Great Britain, and the fisheries are important. Corn, wool, flax, butter, and salt provisions are exported. Rostock was a member of the Hanseatic League. Blücher was born and Grotius died here.

Rotation of a body takes place when any definite straight line in the body does not continue to remain parallel to itself in the different positions it assumes. Suppose the body moves so that the line A B in it ultimately takes up the position A' B'.



ROTATION.

A point, O, may be found about which the line may be considered to have rotated. Join A A' and at the centre of A A' erect a perpendicular M O. Similarly erect N O perpendicular to N, the middle point of B B'. The two perpendiculars meet at O. It can be seen at once that the triangles O A B and O A' B' are equal in all respects; \therefore the angle A' O B' = the angle A O B; \therefore the angle A' O A = the angle B' O B. Hence the point A has rotated through the same angle as the point B, so the whole line may be considered to have rotated about the point O. If M O is parallel to N O, O is at infinity, and the line A B has merely moved parallel to itself, or there has been a motion of translation only. Hence

the translation of a line may be considered as a rotation about a point infinitely far off. If a body be constrained to rotate about several axes which meet in a point, the result is a rotation about one axis, which is, as it were, equivalent to a resultant of the other axes, and is thus found. Lines are drawn representing the component axes in direction, and the lengths of these lines are made proportional to the angular velocities about these axes. If there are only two, the construction is the same as that for the parallelogram of velocities (q.v.), the diagonal representing in direction the resultant axis, and in length the angular velocity about this axis. A third rotation can be compounded with this diagonal, and so on for any number. If a body move in any plane curve, its motion can be considered as the result of an infinite number of small displacements, and at any moment one row of points is quite still. It is about this momentarily fixed line that the body may be considered to be rotating, and this line is therefore known as the *instantaneous axis* of rotation. This axis traces out two curved surfaces, one in space and the other in the moving body, and the whole motion of the body can be obtained by the rolling of one of these curves upon the other. As an example of this, we have the cycloid obtained by the rolling of a circle on a line—the instantaneous axis—now reduced to a point or *instantaneous centre*, being the point of contact of circle and line. Obviously the two curves it traces out are the circle on the body and the line in space. If a rigid body move in any direction whatever, at any moment there is in it a row of points which is undergoing no motion except a translation along its own line; if the motion is somewhat limited by having one point in the body quite fixed, then at any moment there is a row of points remaining absolutely still and forming an instantaneous axis. This axis describes two cones (whose section is by no means limited to a circle), one in the body and one in space. Hence the motion of the body may be regarded as the result of the rolling of one of these cones on the other.

Rotche (*Mergulus alle*), an Arctic bird of the Ank family. It is about nine inches long, black above and white beneath, and visits our northern coasts in winter.

Rothe, RICHARD (1799-1867), theologian, was born at Posen, and studied at Heidelberg chiefly. In 1819 he went to Berlin, and became connected with Neander. He was appointed preacher to the Prussian Embassy at Rome, remaining there five years, during which he formed an intimate friendship with Bunsen. In 1828 he was made professor of theology at Wittenberg, and after nine years proceeded to Heidelberg in the same capacity. In 1849, just after the publication of his notable work, *Theologische Ethik*, in three vols., he went to Bonn, but soon returned to Heidelberg. He was a great thinker, and wrote some very valuable works.

Rotherham, a market-town and municipal borough in the West Riding of Yorkshire, 5 miles N.E. of Sheffield, is at the junction of the Rother and Don, a bridge connecting it with Masborough. There is a fine fifteenth-century church,

a grammar-school (founded 1483), a free library, and two parks. Iron goods, chemicals, earthenware, glass, soap, and starch are manufactured.

Rothschild, a family of Jewish financiers which has for several generations largely controlled the European world. The founder was MEYER ANSELM ROTHSCCHILD (1743-1812), who was born at Frankfort, and who amassed an enormous fortune. He had five sons—ANSELM, who settled in Frankfort, CHARLES, who went to Naples, SOLOMON, whose sphere of operations was Berlin and Vienna, JAMES, who located himself in Paris, and NATHAN, who came to England. The brothers, uniting their credit, gradually exercised tremendous influence in public affairs. Nathan was made Baron by the Emperor of Germany, and died in 1836. His eldest son, LIONEL (1808-79), became M.P. for the City of London in 1847, but, as Jews were unable to take the oath, did not take his seat till 1858. His son, NATHAN, was the first Jew raised to the Peerage (1885).

Rotifera, or WHEEL-ANIMALS, a class of small aquatic animals, which belong to the Worms or subphylum of Vermes. They are of interest from their beauty when examined under the microscope, and from numerous points in their anatomy and life-history. The body never consists of more than one segment. At the anterior end is a disc-shaped mass provided with cilia, the slashing of which causes the disc to appear as if it were revolving: whence the name of the class. The body is generally attached by a process or foot, but in some cases the animal is free-swimming, but has a bifid foot by which it can anchor itself at will (*e.g.* *Hydatina*). The animal is usually protected by a hard cuticle or skin, and this may be surrounded by a tube made of pellets of mud as in *Meliceria*. The body cavity is probably an archicœle (q.v.). In most cases the male is small and degraded, and appears only to live in order to fertilise the female; it has not yet been discovered in one family (the *Philodinadæ*). In some cases the animals can survive for a long period after being completely dried. The systematic position is obscure; the resemblance of the ciliated disc to the similar organ in the larva known as the Trochosphere leads to their inclusion in the Worms. They are world-wide in distribution, live in either fresh or salt water or in damp moss and grass.

Rot of Sheep, the disease caused by the attack of the parasitic worm known as *Distoma* or the "Liver-fluke" (q.v.).

Rotor. If a rigid body undergo a process of translation only, all points in it move through equal distances along lines which are parallel, *i.e.* in the same direction. Hence the motion may be represented by a straight line of definite length and direction drawn anywhere—*i.e.* by a *vector*. The direction of an axis of rotation and the angular velocity are not, however, sufficient to determine the motion of a rotating body, for the *position* of the axis will affect the result. Obviously equal rotations about parallel axes are not the same thing. Hence, to represent a rotation, we must

have a line of definite length, direction, and *position*. This is therefore a localised vector, and was termed by Clifford a *rotor*, the word being given to it in consequence of its connection with the theory of rotating bodies. A force acting on a solid body is a rotor, for it will lead to a different result whether the force act along one particular line or along a parallel to it, the difference between the two results being expressed as a definite couple. A vector remains unaltered wherever it may move in space, provided it keep parallel to itself, but two rotors are only identical when they are in the same line and of the same length and sense. The addition of rotors is affected in the same way as the composition of forces or of rotations, and just as the composition of a number of rotations about any axes gives usually not a simple rotation, but a perfectly general motion of the body, so the result of rotor addition is generally not a simple rotor.

Rottenstone is the soft, friable mixture of sand and clay resulting from the decomposition of siliceous limestones by the action of percolating carbonated water. It may be grey or red, and contains 82 to 86 per cent. of alumina, 4 to 13 per cent. of silica, up to 10 per cent. of carbon and up to 5 per cent. of iron. It should be very fine-grained, meagre to the touch, and almost capable of floating in water. It is obtained chiefly from Derbyshire and South Wales, and is a cheap and efficient polishing material for glass, silver, brass, or other soft metal.

Rotterdam, which takes its name from a dam at the mouth of the Rotte, which flows through the town, is in the province of South Holland, 36 miles west of Amsterdam, next to which it ranks in size and commercial importance, on the right bank of the navigable Nieuwe Maas, but having a quicker communication with the sea by a canal—the Nieuwe Waterweg. The Maas is crossed by two bridges, one of which is a railway bridge. The town is intersected by canals, crossed by drawbridges, and lined with trees. Some of these canals, which are tidal, are deep, and allow the ships to come alongside the warehouses. The river, which is from 30 feet to 40 feet deep, has a fine quay, the Boompjes, $1\frac{1}{2}$ miles long, and edged by elms planted in 1615. There are many quaint gabled houses, and in the Groote Markt is a statue of Erasmus, who is also commemorated by a Latin school. The fifteenth-century Groote Kerke has monuments of De Witt, Kartenaar, and De Brakel, and a very fine organ, said to be better even than that of Haarlem. Other places of interest are the old East India House, the Government dockyard and arsenal, and the schools of medicine and navigation. There is much commerce with the East and West Indies, and to Great Britain are exported cheese, butter, ducks, gin, sheep, cattle, and flax; besides much other foreign trade, especially the inland Rhine trade. The chief industries are distilling, brewing, dyeing, tanning, and the manufacture of sugar, vinegar, and candles, and shot. There is much ship-building.

Roubiliac, LOUIS FRANÇOIS, sculptor, was born early in the 18th century at Lyons, and came

to England in his youth. He speedily made a reputation by his occasionally good conceptions and excellent finish, and executed many works, some of which are in Westminster Abbey. He died in 1762, and was buried in the parish of St. Martin's, London.

Rouen, anciently capital of Normandy, and now of Seine-Inférieure, is in a gently-sloping valley on the Seine, 87 miles N.W. of Paris. Rouen is on the right bank, and is connected by two bridges with St. Sever on the left. There is a beautiful view from St. Catherine's Hill on the S.E. The town is dark and dirty, though very antique, and in the W. and alongside the quays there are some fine buildings. The cathedral—begun in 1220—has a west-front opening upon the flower-market, this front being flanked by two towers and covered with statues and carvings. Its length is 435 ft., breadth 124 ft., and height $89\frac{1}{2}$ ft., and the style Early Pointed, and it has three large rose windows. There are also good stalls and some painted glass, while within are tablets commemorating the burial there of Richard I., Geoffrey Plantagenet, and John, Duke of Bedford. Other objects of interest are the Archbishop's Palace, St. Ouen's Abbey with its perfect church, Tour de la Grosse Horloge, Hôtel de Ville, 15th-century Palais de Justice, the Musée, and the Anciennes Halles. In the Place de la Pucelle a statue of Joan of Arc marks the supposed place of her death. For its cotton manufacture Rouen has been called the Manchester of France, while some of its special goods have the name "rouenneries." Other industries are the manufacture of woollen goods, machines, soap, chemicals, earthenware, sugar, copper, iron, together with spinning, tanning, bleaching, dyeing. There is much trade with Paris and Havre, and large ships can ascend to Rouen. The journey by boat to Havre is interesting for its scenery and the places which are passed.

Rouge. Jeweller's rouge, employed as a polishing powder for gold and silver and also used for cosmetic purposes, consists of an oxide of iron—ferric oxide (Fe_2O_3)—and is obtained by heating the sulphate, carbonate, or hydrate of iron in presence of air.

Rouge-et-Noir, a somewhat complicated gambling game, introduced into France in 1789, but now prohibited in France and Germany, and flourishing only at Monte Carlo. The table upon which it is played has rounded ends, and is narrow in the middle, being divided into four sections, each of which is marked by red and black diamonds alternately. Bands crossing the narrow part of the table divide it into halves, and the ends of the table have concentric yellow bands. Six full packs are used, and after cutting a row of cards to the number of 31 or more is dealt to *Noir*, and another to *Rouge*. The court cards count 10, and the rest according to pips, and the row that makes nearest to 31 wins. If the rows are of equal value, it is a *refait*, and a new deal is required. If each row makes 31, there is a *refait de trente-et-un*, and the bank gets half the stakes. Other points in the

game are *couleur* and *inverse*, the former winning if the first card be of the winning colour, the latter if the contrary be the case.

Roulette, a French game of chance, now suppressed. The table has a depression in the centre surrounded with 37 or 38 cells, alternately red and black, numbered 1 to 36, with zero and (in case of 38) double zero. A ball is thrown upon a disc revolving in the central depression, and it drops into one of the cells. Upon the table are arranged the numbers of the cells with the zero or zeros, and the words *pair*, *passe*, *noir*, *impair*, *manque*, *rouge*. A player may stake upon any of the numbers or zeros, and on any of the words mentioned. If he stakes on one number and wins, he receives 36 times his stake (counting the stake), if on two numbers 18 times his stake, and so on, a winning stake on 12 numbers bringing him 3 times his stake. A winner on one of the words receives the equal of his stake. *Pair* wins when the ball falls into an even number, *impair* when into an odd number, *manque* if in any from 1 to 18, *passe* if in any from 19 to 36, *rouge* if into a red cell, *noir* if into a black one. If the ball falls into zero, the stakes of those staking on the words are either divided equally between the bank and the players or are "put into prison," in which case the bank or the players take all, according to the chances of the next throw.

Roumania, a kingdom of S.E. Europe, includes what were known as the Moldo-Wallachian principalities, together with the Dobrudsha on the Black



MAP OF ROUMANIA.

Sea. Their independence was secured by the Treaty of Berlin (1878), and the kingdom was formed in 1881. Its area is 46,314 square miles, and the soil is mostly rich, but suffers from drought, and the extremes of heat and cold are great. Wheat, maize, millet, barley, rye, beans, and peas are grown, and fruits are abundant, including the grape, which makes good wine when care is bestowed upon the preparation. There are extensive forests, and cattle, sheep, and hogs are largely bred, while excellent horses are exported to Austria and Germany for cavalry purposes. Though minerals abound, salt, saltpetre, and petroleum are

the chief that are worked. The river system belongs to the Danube, the other principal rivers being the Sereth, Moldava, and Pruth. The Court language used to be Greek, but French is now used. The legislative functions are exercised by the king, a senate of 120 elected for 8 years, and a house of 183 deputies elected for 4 years, the method of election being the *scrutin de liste*. [RUMANIANS.]

Roundheads was the name bestowed in the Civil War by the Royalists upon the Parliamentary troops, in reference to the closely-cropped hair which contrasted strongly with the long locks of the Royalists. The equivalent *tête-ronde* is still applied as a term of reproach in one part of Europe to signify a racial and religious difference, the people so called terming their opponents *tête-carrée* or square-heads.

Round Towers are found in Ireland to the number of 118, of which 20 are more or less perfect, and Scotland possesses 3. As to their origin, many theories have been broached, some attributing them to the Phœnicians, and others to the Danes, but general opinion now deems them to be of Christian origin and to date from the 5th to the 13th century. It is probable that they were used for storing church utensils, also as strongholds, and, upon occasion, as beacons and watch-towers. They are generally from 50 to 120 ft. high, diminish in size as they ascend, and are topped by conical roofs. They are divided into storeys communicating with each other by ladders, and each possessing a window, more windows occurring near the roof. The doors were for the most part 8 or 10 ft. from the ground.

Round Worms. Certain worms belonging to the order Nematoda (q.v.) are parasitic in man. They are elongated worms, a transverse section through the body of which is more or less circular or "round." The chief members of this group are the common round worm or *Ascaris*, the threadworm *Oxyuris* [THREADWORM], and the *Trichina spiralis*. [TRICHINOSIS.] The common round worm is about 8 inches long and a third of an inch thick. The male is somewhat smaller than the female. The worm inhabits, as a rule, the small intestine, and there are rarely more than 5 or 6 of them found at one time. The symptoms to which the presence of this worm gives rise are usually of a very indefinite character, the most reliable indication of their presence being the demonstration of their ova on microscopic examination of the discharges from the bowel. The remedy usually employed is *santonin*.

Roup is a formidable contagious disease which sometimes affects poultry, particularly when they are overcrowded and kept in a dirty condition. The symptoms are those of severe catarrh with discharge from the mouth, nostrils, and eyes.

Rousseau, JEAN BAPTISTE (1670-1741), French poet, was the son of a shoemaker, and was born in Paris. He received a good education, and was appointed page to the French ambassador in Denmark, and afterwards secretary to the French Embassy in London. He wrote a great many poems, and in 1712 was banished from France for,

as was said, writing libellous verses, but he always strenuously denied the authorship. He went to Switzerland, and thence to Vienna, where Prince Eugene protected him. He died in Brussels, leaving a great reputation as a lyrical poet. His poems, now seldom read, were published in 2 vols. in 1723.

Rousseau, JEAN JACQUES (1712-78), French philosopher, was the son of a watchmaker at Geneva, who gave him a fairly good education. He was put in an attorney's office at first, but was soon dismissed, and was then indentured to an engraver; but, not liking his employment, ran away, and led a wandering existence for some time. He was taken charge of by a priest, who confided him to Madame De Warens, a convert to Catholicism, who succeeded in converting him from Protestantism. He passed some years with her very happily, and never ceased to speak of her with affection. In the end his connection with her became still more intimate. He succeeded in very little that he undertook, but he learned music, and began to compose it. He could not bear control, and gradually became very jealous and suspicious, and in 1740 left Madame De Warens, chiefly through jealousy, and in 1742 became secretary to the French ambassador at Venice. He went to Paris afterwards, and managed to live by copying music. He there formed a connection with Therèse le Vasseur, servant at an inn. He had five children by her, who were sent to the foundling hospital soon after birth, and were never traced. In 1750 he competed for the prize offered by the Dijon Academy for the best essay on the question whether learning had improved morality, and, replying in the negative, won. It brought him reputation, and he soon after composed *The Village Seer*, a comic opera, both words and music, which was successful. His *Letter on French Music* (1753) aroused much animosity, and he retired to Geneva, changing his religion once more. Thenceforward his life was miserable. He published successively *The Origin of Inequality among Mankind*; *Julie, or the New Eloisa* (1760); *Emile, or Education* (1762), and *The Social Contract*, the theories of which are constantly traceable as influencing the French Revolution. Each of these caused a sensation, partly by their boldness, partly by their tremendous passion and eloquence. *Emile* was burnt publicly at Geneva and Paris, and he was obliged to fly. David Hume brought him to England, but he had become so morbidly suspicious that he left him abruptly, and was at length allowed to return to Paris. His death occurred suddenly at Ermenonville, and in 1794 his remains were exhumed and reinterred in the Panthéon. His wonderfully vivid *Confessions* appeared after his death. The best English biography of him is that by John Morley (1873).

Rousseau, THÉODORE (1812-67), landscape-painter, was born in Paris, and studied under excellent masters. He travelled for a year or two, and exhibited at the Salon in 1831. In 1835 he was rejected by the jury of that institution and was kept outside till 1849, the reason being that he

was a romanticist and the jurymen were classical in their tastes. Rousseau was a fine painter, and was finally recognised as a master outside a narrow circle. He has had many followers and imitators. In 1852 he received the Legion of Honour.

Rowan, commonly but misleadingly known in England as the Mountain Ash, is a rosaceous tree (*Pyrus Aucuparia*), native to Europe and Northern Asia, with smooth, ash-grey bark, alternate pinnate leaves with 13 to 17 serrate leaflets; large corymbose cymes of small, creamy-white flowers; and small, scarlet pomes with yellow flesh. It grows at altitudes of 2,600 feet in the Scottish Highlands in rocky situations; and, whilst in Wales and in Kamtschatka drinks are prepared from the berries, they are chiefly noticeable for their beauty in early autumn and as a favourite food of thrushes and other birds. Much legendary lore centres round this tree, which in Scotland is the badge of the M'Lachlans; its wood seems to have been used in divination, and its name is said to be connected with the word "run," a mystery.

Rowe, NICHOLAS (1673-1718), poet and dramatist, was the son of a lawyer, and was born in Bedfordshire. He was educated at Westminster School, and was intended for the law, but preferred to write for the stage. His first tragedy appeared when he was twenty-four, and he afterwards wrote many others—notably *Jane Shore*, *The Fair Penitent*, *Tamerlane*, and *Lady Jane Grey*. On George I.'s accession he was made Poet-Laureate, his most remarkable achievement in poetry being his version of Lucan's *Pharsalia*. He was buried in Westminster Abbey.

Rowing is the art of propelling a boat by means of sculls or oars. Since the advance of knowledge in the use of sails, and especially since the introduction of steam, rowing has been restricted to small boats, though in ancient times (and in later times in the case of galleys for slaves) large craft have used this mode of progression. The principle of rowing is an application of the lever, the water forming the fulcrum, and, though the oar seems to move a considerable distance through the water, the distance traversed by it is small. The chief points of good rowing are to get a good reach forward, to put the whole weight of the body into the stroke, and to feather, that is, to bring the oar back with the blade flat without touching the water and so stopping the way of the boat. The introduction into England of the sliding-seat, in 1871, has worked a great revolution in English rowing. The difference between rowing and sculling is that in the latter a man uses two oars, one on either side, and in the former he uses one oar only.

Rowlandson, THOMAS (1756-1827), caricaturist, was born in London, and studied drawing at the Royal Academy and in Paris. He had a remarkable facility, and, in spite of his dissipated conduct, managed to produce thousands of his humorous illustrations of life. He was a keen observer, and did the clever designs for *Dr. Syntax's Tour*, *The Dance of Life*, and *The Dance of Death*. In 1880 a *Selection from his Works*, with a sketch

of his life, was brought out by Joseph Grego in two volumes.

Roxburghshire, an inland county of Scotland, having Dumfries on the S., Cumberland and Northumberland on the S.E. and E., Berwick on the N., Midlothian and Selkirk on the W. It contains 425,660 acres, of which two-fifths are cultivated. The land is undulating, and rises to the Cheviots from E. to S.W., and Carter Fell, etc., to the N. The hills afford excellent pasture, and sheep-walks are the great feature of the country. The woollen manufacture is carried on at Hawick and Jedburgh. At Kirk Yetholm is a great colony of gipsies. The principal rivers are the Tweed, Teviot, Gala, and Leader. The principal towns are Jedburgh, Hawick, Kelso, and Melrose.

Roy, WILLIAM, was a general in the army who became distinguished as an antiquary and geodesist. He was one of the originators of the great trigonometrical survey of Great Britain, being employed in 1746 to make a military map of Scotland, a work he carried out thoroughly. In 1767 he was made F.R.S., and later obtained the Copley Medal for his great achievement in successfully measuring the Hounslow base, the first step towards making an ordnance survey of the United Kingdom. He died July 1st, 1790. His valuable *Military Antiquities of the Romans in Great Britain* was published after his death.

Royal Academy, THE, was founded in 1768 under the auspices of George III., and has for its object the encouragement of painting, sculpture, and architecture. It consists of 42 Academicians, of whom 2 must be engravers, and of 36 Associates, of whom 5 must be engravers, and gives instruction in painting, sculpture, architecture, and anatomy, rewarding merit with medals and other prizes, besides associateship and membership. The Academy is at present lodged in Burlington House, and holds an annual exhibition of painting by living artists (May to August), and a winter exhibition of 10 weeks, beginning in January, of the works of Old Masters and dead British artists, while the collection of diploma pictures is to be seen daily.

Royal Family, THE, consists, in England, of the Queen Consort of the reigning sovereign, the Queen Dowager, and the lineal descendants of a reigning sovereign. The consort of a reigning queen is not a member of the Royal Family, unless, as in the case of Prince Albert, that rank has been specially conferred upon him. The Prince of Wales (Albert Edward, b. 1841) at present receives, in addition to the revenues of the Duchy of Cornwall, £40,000 a year with an additional £36,000 for his children, the Princess of Wales £10,000 with a prospective £30,000 in case of widowhood, and other members of the Family receive proportionate allowances. The following is a list of the principal members:—

Queen Victoria -	b. 1819	Duke of Coburg -	b. 1844
Princess Royal, Dowager		Princess Christian -	b. 1846
Empress of Germany	b. 1840	Marchioness of Lorne	b. 1848
Albert Edward, Prince		Duke of Connaught -	b. 1850
of Wales -	b. 1841	Duke of Albany	b. 1853, d. 1884
Princess Alice	b. 1843, d. 1878	Princess Beatrice -	b. 1857

Royal Society, THE, had its origin in a club of learned men, formed in 1645, and meeting first in London, then at Oxford, and then again in London. In 1658 they used to meet at Gresham College, where lectures were delivered, and in 1662 they were incorporated as the President, Council, and Fellows of the Royal Society founded for improving the knowledge of Natural Science. In 1665 the Society first began to publish its *Philosophical Transactions*, and from 1703 to 1727 Sir Isaac Newton was its President. It removed to Burlington House in 1857, and has done much service as scientific adviser to the Government. Research is encouraged by the award of medals and prizes.

Royalty, a payment reserved by the grantor of a patent lease of a mine or similar right, and payable proportionately to the use made of the right by the grantee. It is usually a payment of money, but may be a payment in kind—that is, of part of the produce of the exercise of the right. Royalty has also another signification, viz. a payment made to an author or composer by an assignee or licensee in respect of each copy of his work which is sold, or to an inventor in respect of each article sold under the patent.

Royer-Collard, PIERRE PAUL (1763–1845), statesman and philosopher, was a lawyer in Paris at the opening of the Revolution, which he at first welcomed, but his sympathy for the Bourbons nearly cost him his life. In 1797 he was elected a member of the Council of Five Hundred, but soon retired. In 1811 he became known to Napoleon, and received some valuable appointments. He taught the philosophy of the Scottish school, and caused the works of Stewart and Reid to be translated. He became Vice-President of the Chamber of Deputies in 1816, and President in 1827, and in the latter year was admitted to the Academy. He retired in 1830.

Rubber, a convenient collective name for those mixtures of hydro-carbons with an oxidised substance, found in the latex (q.v.) of most plants, which are pliable and are insoluble in water, alcohol, or unconcentrated acids. Only within the tropics, between the isotherms of 70° F., where the annual rainfall is about 90 inches, do the trees produce this latex in abundance. The chief kinds in commerce are (1) “American,” including Pará, Carthagená (from New Granada), and Ceará; (2) “West Indian,” including Guayaquil (from Ecuador), Pernambuco, Maranhão, Nicaragua, Honduras, and Guatemala; (3) “Asiatic,” including Singapore, Assam, Penang, Java, Siam, and Borneo; and (4) “African,” including Madagascar and West Coast. Of these, the Pará, or Cahout-chou, from the Amazon valley, is the most valuable. It is the produce of various species of the euphorbiaceous

genus *Hevea* (*Siphonia*). Carthagená, Guayaquil, Nicaragua, Honduras, Guatemala, and other West Indian or “Ulé” rubbers come from *Castilloa*, belonging to the Bread-fruit family. Ceará rubber is derived from the euphorbiaceous *Manihot Glaziovii*; that of Pernambuco from *Mancorna speciosa*, belonging to the Periwinkle family; the “Gutta süssu” of Borneo and the “Gutta singarip” of Malaysia, from species of *Willughbeia*; and African rubbers from species of *Landolphia* and *Vahea*, all belonging to the same family. The caoutchoucs of Assam, Sylhet, and probably Singapore, are the produce of species of *Ficus*, of which *F. elastica* is the best known. Though india-rubber has long been known, the discovery of the process of vulcanising gave so great a stimulus to the trade in it that this trade may almost be said to belong to the last quarter of a century. Exclusive of guttapercha (q.v.), our imports of raw rubber have grown as follows:—

1830 - - -	464 cwt.	1870 - - -	152,118 cwt.
1840 - - -	6,640 „	1880 - - -	169,587 „
1850 - - -	7,616 „	1890 - - -	264,000 „
1860 - - -	43,039 „		

Nearly half of the import now comes from Brazil, the Gold Coast and Bombay contributing the next largest amounts. The United States now imports as much as we do, and our exports of manufactured rubber are valued at nearly 1½ millions sterling annually. [CAOUTCHOUC.]

Rubefacient, a form of external application designed to produce a reddening of the skin and mild counter-irritation (q.v.).

Rubens, SIR PETER PAUL (1577–1640), Flemish painter, was born in Westphalia, and was taken to Antwerp when ten years of age. He received an excellent education, and began to study art there, afterwards voyaging in Italy, where he occupied himself in copying the masterpieces of Titian and others. The Duke of Mantua took an interest in him and gave him some commissions, and also sent him on an embassy to Madrid. In 1608 he returned to Antwerp, and was made Court painter to the Archduke Albert. The Princess de Medicis employed him to paint a series of scenes in the Luxembourg, and there he made the acquaintance of the Duke of Buckingham. He came to England soon after, and was taken into favour by Charles I., to whom he presented his magnificent *Peace and War*, now in the National Gallery, and whose portrait he also painted. For this he was knighted. He became enormously wealthy, and was twice married. He died at Antwerp, in which city the tercentenary of his birth was kept as a festival. It possesses *The Descent from the Cross*, generally considered his best work. Rubens was twice married.

Rubeola, another name for measles (q.v.).



THE
STOREHOUSE
OF
GENERAL INFORMATION



RUBIACEÆ—ZYMOTIC

CASSELL AND COMPANY, LIMITED

LONDON, PARIS & MELBOURNE

1894

ALL RIGHTS RESERVED

AUTHORS OF PRINCIPAL ARTICLES.

RUSSIA	G. H. PERRIS.	SPECTRUM AND OTHER PHY-	L. EDNA WALTER.
SALMON AND OTHER ZOO-	H. SCHERREN, F.Z.S.	SICAL ARTICLES	
LOGICAL ARTICLES ...		SPENCER, HERBERT ...	D. J. O'DONOGHUE.
SCHOLASTICISM	A. H. MANN.	SPENSER, EDMUND ...	J. F. CHARLES, M.A.
SCOTLAND	FINDLAY MUIRHEAD.	SPIDERS, SPONGES, AND	J. W. GREGORY, D.Sc., <i>British</i>
SCOTT, SIR WALTER ...	J. F. CHARLES, M.A.	OTHER ZOOLOGICAL ARTI-	<i>Museum.</i>
SEMITIC RACE AND LAN-	PROF. A. H. KEANE, <i>Vice-</i>	CLES	
GUAGES	<i>President of the Anthropological</i>	STAMEN AND OTHER BO-	PROF. G. S. BOULGER.
	<i>Society.</i>	TANICAL ARTICLES ...	
SEWER... ..	W. H. HAMER, M.A., M.D.	STARS AND OTHER ASTRON-	L. EDNA WALTER.
	Cantab.	OMICAL ARTICLES... ..	
SEX AND OTHER BIOLOGICAL	PROF. G. S. BOULGER.	STOCK EXCHANGE	H. E. ANDREWES.
ARTICLES		SWEDEN	H. L. BRAEKSTAD.
SHAKESPEARE	PROF. EDWARD DOWDEN.	SWIFT	W. W. HUTCHINGS.
SHELLEY	W. W. HUTCHINGS.	SWITZERLAND	J. SOWERBY.
SILVER... ..	L. M. JONES, B.Sc.	TEMPERANCE	ROBERT RAE, <i>National Tem-</i>
SLAV RACE AND LANGUAGES	PROF. A. H. KEANE.		<i>perance League.</i>
SMALL-POX AND OTHER	W. H. HAMER, M.A., M.D.	TENNYSON	J. F. CHARLES, M.A.
MEDICAL ARTICLES ...	Cantab.	THACKERAY	W. TEIGNMOUTH SHORE.
SOCIALISM	SYDNEY OLIVIER, <i>Fabian</i>	WALES	W. J. WILLIAMS, B.A.
	<i>Society.</i>	WORDSWORTH	A. H. MANN.
SOUND	L. EDNA WALTER, B.Sc.	ZOOLOGY	H. SCHERREN.
SPAIN	A. HILLIARD ATTERIDGE.		

LIST OF PLATES.

MAP OF THE WORLD SHOWING EUROPEAN COLONIES	... ..	Frontis.
SHAKESPEARE ... ..	... ..	To face page 65
MAP OF BRITISH ISLES (INDUSTRIES)	... ..	129
TELESCOPES ... ..	... ..	193
MAP SHOWING COMMERCIAL PRODUCTS OF THE WORLD	... ..	257
WRITING ... ..	... ..	321

CASSELL'S STOREHOUSE OF GENERAL INFORMATION.

Rubiaceæ, the third largest order of Dicotyledons, comprising over 4,000 species in nearly 350 genera. Though the tribe *Galieæ*, which is largely represented in England, including Bed-straw (*Galium*), whence the family is named, Woodruff, Madder, etc., is almost exclusively temperate, the other twenty-four are mainly tropical. They include plants of all sizes, usually with square stems. The leaves are opposite and decussate, simple and stipulate, the stipules in *Galieæ* being as large as the leaves. The floral whorls have 4 to 6 leaves each and alternate, there being only one whorl of stamens and, as a rule, only two carpels. Both calyx and corolla have their leaves united, and are generally polysymmetric. The ovary is inferior, the fruit various, and the seeds generally albuminous. The order includes the Cinchonas, Ipecacuanha, Coffee, and Gambir, which are noticed separately, besides the fragrant *Bourardia*, *Rondeletia*, and *Gardenia* of our greenhouses.

Rubicon, THE, a small river of Northern Italy, formerly considered as the boundary between Italy and Gaul. Julius Cæsar by crossing this took the irrevocable step which resulted in making him the ruler of Rome. The phrase "crossing the Rubicon" has now become proverbial to denote the adopting of any decided measure which commits one to a course of action.

Rubidium (RB 85·2). This element was first discovered by Bunsen in 1861, the source being some mineral waters from Durkheim, and the method the application of spectroscopic analysis. By this means the presence of the metal could be detected in a few drops of the water, although many tons had to be used before sufficient could be obtained to experiment with. The metal closely resembles potassium, igniting if thrown upon water. Its salts also are very similar to those of potash. Although only existing in very small quantities, the metal is very widely distributed, being found in sea-water, many mineral waters, sea-weeds, tobacco, tea, and many other plants, as well as associated with potassium in many minerals.

Rubinstein, ANTON GEORG (b. 1829), famous Russian pianist, was born of Jewish parents, and in 1839 his bent towards music was recognised by his being sent to Paris to study under Liszt. He travelled afterwards through England, Germany, Holland, etc., and in 1845 settled in Berlin and took

lessons from Dehm, thence proceeding to Vienna, where he taught pupils for a time. He had already composed some fine pieces for the pianoforte, and was gradually accepted as a great musician. After several tours he became Imperial Concert Director at St. Petersburg, and received various decorations and honours. He has composed a great deal, and has done much for Russian music. In 1889 his jubilee was celebrated by the Russians as a national festival.

Rubrics originally meant titles or articles in a common-law book, from the fact of their being written in red ink. It was then applied ecclesiastically to the rules and directions for conducting the liturgy and services generally. In the English Prayer-book the rubrics are sometimes printed in italics, and sometimes in red ink.

Ruby, or RED SAPPHIRE (q.v.), one of the most valuable of gems, is the red, translucent variety of crystalline alumina. It is found chiefly in Burmah, where the mines are now worked by an English company. This stone is often termed the *Oriental ruby*, the best colour being known as *pigeon's-blood*. The ordinary ruby of lapidaries and watchmakers is red spinel (MgOAl_2O_3), crystallising in the Cubic system. It is also called the *spinel ruby*; when rose-red, the *balas ruby*; when orange-red, the *rubicelle*; or when violet, *almandine ruby*. [SPINEL.]

Rückert, FRIEDRICH (1789–1866), German poet, was born at Schweinfurt, and studied at Jena University, of which he became one of the lecturers. Between 1815 and 1816 he was editor of a paper at Stuttgart, and travelled in Italy after giving it up. He settled in Coburg and married there, and made a close study of Oriental literature, nearly all his poetry being coloured by it. His first volume, *German Poems*, appeared pseudonymously in 1814, and was followed by many others. He is one of the most notable of German poets, and several biographies of him have been published. From 1826 to 1849 he was professor of Oriental literature at Erlangen and Berlin.

Rucuyennes, South American Indians, widespread throughout French Guiana, but especially in the Tumuc-Humac Mountains about the headwaters of the Maroni, Paru, and Yary rivers; they call themselves *Wayana*, a modified form of *Guiana*,

Rucuyenne being the name given them by the surrounding tribes from the red *rucu* dye with which they paint themselves. The Rucuyennes are a branch of the Carib race, and appear to have formerly been cannibals; they still practise many barbarous customs, such as exposing the youth of both sexes to the sting of ants and wasps as a test of endurance at the age of puberty. The traveller Crevaux asserts that the Rucuyennes are no taller than European girls of twelve, and that at birth they are nearly white, afterwards changing to a bronze or swarthy colour. (*Voyages, Tour du Monde*, June, 1879.)

Rudd. [RED-EYE.]

Rudolph I. (1218–91), founder of the Imperial House of Austria, and Emperor of the Romans, was the son of Albert IV., Count of Hapsburgh. Under the king of Bohemia he served against the Prussians, and became known for valour and wisdom. He was elected Emperor of the Romans, but the king of Bohemia, refusing to accept his election, rebelled, and was defeated in battle and slain in 1278. Rudolph reigned with great success for nineteen years.

Rue (*Ruta graveolens*), the type of the large order Rutaceæ, a native of the south of Europe, commonly cultivated in England, is a shrubby plant, two or three feet high, with pinnately divided bluish-green leaves, beset with glands containing a powerfully-smelling oil, and with corymbs of yellowish flowers. The calyx consists of four persistent sepals; there are four distinct petals, eight or ten stamens of unequal length, and four carpels united into a stalked four-chambered ovary with a single style. The plant is used to keep off noxious insects, and as a stimulant and narcotic in flatulence and hysteria; but is dangerous in large doses.

Rue, OIL OF, is one of the class of substances known as *essential oils* [OILS], and is obtained from Common Rue (*Ruta graveolens*) by distillation with water. It is a bitter liquid, with a disagreeable odour. It may be solidified if cooled, and boils about 230°. Chemically it consists chiefly of a compound known as *methyl-nonyl-ketone* ($C_{11}H_{22}O$), which is a fluorescent liquid boiling at 225°. The oil is used in medicine, although not very extensively.

Ruff (*Machetes pugnax*), a bird of the Snipe family, the sole species of its genus. It was formerly abundant in Britain, especially in the fens; but since that part of the country has been brought under cultivation the bird has been driven from its old haunts, and is chiefly known as a visitor. The male bird is about a foot long, and in breeding season develops a crop of curly feathers on the sides of the head and round the neck a large ruff, which serves as a shield in its combats with its rivals. The general plumage is brown with black and white markings; the ruff varies greatly in colour. The hen-bird, or Reeve, is smaller. These birds were formerly fattened for the table.

Rugby, a town of Warwickshire, pleasantly situated on the Avon, 15 miles N.E. of Warwick. It is an important railway junction, and has a fine

station; but it is chiefly known for its public school, founded by Lawrence Sheriff in 1567, which has a great reputation and has an endowment of £5,000 a year, and is housed in handsome buildings. The modern renown of the school is owing to Dr. Arnold and his worthy successors—Archbishop Tait, Dr. Jex Blake, and others—and to the prestige brought to it by Dean Stanley, Thomas Hughes, and other old Rugbeians.

Ruge, ARNOLD (1802–80), German publicist, was born at Bergen, and studied philosophy at the university of Jena, where, with other students, he went into rebellion, and received six years' imprisonment in consequence. He was a follower of Hegel, and in 1830 published a translation of the *Edipus Coloneus* with a tragedy of his own, and in 1832 a work on *The Aesthetics of Plato*. He started journals of an advanced type at Halle, where he was professor of philosophy, and at Dresden, and finally had to leave the country. He went to Paris, thence to Switzerland, and subsequently to London, where he engaged in educational work. After 1870 he became an adherent of the German Empire.

Rugosa, a group of Corals, including most of those of the Palæozoic period, and therefore of much interest to geologists. The value of the order is, however, very uncertain, and some zoologists are inclined to merge it in the "Aporosa" group of ordinary Corals. It differs from this by the fact that the septa are arranged in multiples of four and not of six, and that there is usually one or more fossulæ, or gaps left by the suppression of one or more of the septa. The Rugosa are divided into three groups:—

- (1) *Cyathophylloidea*, in which there is a zone of vesicular tissue around the margin of the coral.
- (2) *Zaphrentoidea*, in which this zone is absent, and the spaces or "loculi" between the septa are open.
- (3) *Cystiphyllloidea*, in which the whole coral is full of vesicular tissue, while the septa are reduced to mere marginal striæ. The members of this group occur only in the Silurian and Devonian.

Rum, an ardent spirit distilled from fermented molasses. The mixture is allowed to ferment for a period varying from nine to fifteen days, and is then sent to the still. The first product is called "low wines," and the second distillation results in rum, the "Jamaica proof" rum being such as will admit of the sinking in it of olive-oil. One of the constituents of rum is butyric acid, and spurious rum is sometimes made by the admixture of this acid to other spirit. Pine-apple rum owes its name and peculiarity to the addition of sliced pine-apples to the fermenting mixture. Much rum is now received from British Guiana.

Rumanians, a people of the Lower Danube basin and Balkan Peninsula, who are distinguished from all the surrounding populations by their Romance (Neo-Latin) speech, and who are therefore supposed by many ethnologists to be the direct descendants of the Roman military colonists settled in Dacia (the present Rumania) after its conquest by Trajan, hence often called "Daco-Romans." But there are some almost insuperable objections to this theory, and, despite their apparent

homogeneity, the Rumanians are now known to be of extremely mixed descent, including, besides a slight Daco-Roman substratum, Goths, Huns, Gepidæ, Slavs, and others, all of whom, thanks to their remarkable power of assimilating foreign elements, have been completely merged in a single homogeneous nationality of uniform speech, customs, and political aspirations. Besides the aberrant Kutzo-Vlachs (q.v.) of the Pindus Range, there are three main divisions—(1) the Moldavians; (2) the Wallachians, these two forming the great bulk of the inhabitants of the kingdom of Rumania, and numbering about 4,500,000; (3) the Rumanians of Transylvania and other parts of Hungary—2,630,000—to which must be added numerous Rumanian communities in Austria, Servia, Bulgaria, and Bessarabia (Russia), making a total population of from 9 to 10 millions of Rumanian speech. This Italic language, which is cultivated and written both in the Cyrillic (Slav) and Roman alphabets, contains many Slav, Turkish, and Greek elements, and is distinguished from the other Neo-Latin tongues both by its phonetic system and by some structural peculiarities, such as the postfixed article, probably an inheritance of the old Thraco-Illyric language, surviving also in modern Bulgarian and Albanian; thus, *omul* = “man-the,” from the Latin *homo ille*. Rumanian is spoken almost everywhere with remarkable uniformity, so that there are no distinct dialects except that of the Kutzo-Vlachs. (Rössler; Paul Hunfalvy.)

Rumford, COUNT (1752–1814), scientist, whose real name was BENJAMIN THOMPSON, was born in New England, and acquired in early youth a taste for natural philosophy, which he studied deeply. During the War of Independence he favoured the English connection, and in 1776, on coming to England, was made F.R.S., and four years later Under-Secretary of State. He had some military and administrative capacity, and was sent to America in command of a troop, and on his return was knighted. He then entered the Duke of Bavaria's service, and did much work in civil and military posts. He became a Count, and in 1799 returned to England. He made some valuable experiments concerning heat, and helped to found the Royal Institution. His complete works were published in five volumes in 1876.

Ruminants, even-toed Ungulates that chew the cud. These are musk-deer, antelopes, sheep, goats, oxen, giraffes, camels, and llamas.

Runcorn, in Cheshire, a port on the left bank of the Mersey, 12½ miles S.E. of Liverpool. It has a town hall and a public hall, and large docks which are now in connection with the Manchester Ship Canal. The L. & N.W.R. crosses the river by a fine lattice bridge. Ship-building, rope-making, and tanning are carried on, and there are chemical and soap works.

Runeberg, JOHAN LUDWIG (1804–77), Swedish poet, was born in Finland, but always used the Swedish tongue, and his first volume of poems (1830) met with an enthusiastic welcome from Sweden. He graduated at Abo University,

and became Roman tutor at the university of Helsingfors, and afterwards professor of Greek and Latin at Borga Gymnasium, of which he was chosen rector at a later period. In 1851 he visited Sweden, and was hailed as a great poet. After 1863 he wrote little. His lyrics are often very beautiful, and have been translated into English. Among his works should be mentioned *The Elk-Hunters* (1832) and *Hanna*, an idyll (1836).

Runes, a written language of the Northern tribes of Europe. The Norse runic alphabet contained sixteen characters, while the Anglo-Saxon contained forty. The Germans practised runic writing, and Goths and other Teutonic tribes carried the practice to Spain, etc. The alphabet is sometimes ascribed to the Phœnicians, but many hold that it did not originate till after the introduction of Christianity. Owing to its employment in magic rites, the Church looked with disfavour on its use. The word in Old Norse means also “a secret”: cf. Germ. *raunen*, “to whisper.”

Runic. [RUNES.]

Runner, a prostrate branch rooting at its node, where it gives rise to new plants, as in the strawberry and some allied plants.

Rupee, a silver coin of India, contains 16 annas, and has varied from 2s. to 1s. 3d. in value. The closing of the Indian mints in 1893 made it a token coin of the nominal value of 1s. 4d. sterling. The depreciation is a serious matter for Indian finance. 100,000 rupees equal a *lac*, and 10,000,000 a *crore*.

Rupert, PRINCE (1619–82), was a son of the Elector-Palatine of Bavaria, and came to England in 1642, commanding the cavalry of Charles I. during the Civil War. His great but somewhat ferocious valour was conspicuous at Edgehill, at Chalgrove, where Hampden was fatally wounded, and at Naseby. He took Bristol, raised the siege of York, and was thoroughly beaten at Marston Moor in 1644. After his surrender of Bristol the king dismissed him, and he went buccaneering in the West Indies, and at a later date won naval distinction in the war against the Dutch. The last years of his life were mainly occupied with scientific research, and he is believed to have invented the art of mezzotint engraving. He helped to establish the Hudson Bay Company, and was its first governor, Rupert's Land being named after him. He was buried in Westminster Abbey.

Rupert's Drops, said to have been discovered by Prince Rupert, are little drops of melted glass dropped into water. The outside is therefore suddenly cooled and forms a solid skin round the still liquid interior. The interior as it cools tends to contract, but cannot on account of the forces which cause it to adhere to the solid skin. The whole is therefore in a state of strain, and a slight disturbance is sufficient to cause a complete disintegration of the whole. Thus, if the end be broken off or a scratch made on the drop, it falls to powder with almost explosive violence.

Rupia, a form of skin disease, in which blebs appear upon the skin, the contained fluid being at

first serous and later purulent. A scab ultimately forms covering a subjacent ulcer; the scab is thick, and in *rupia prominens* it is shaped like a limpet shell. *Rupia* usually occurs in association with syphilis.

Rurik, founder of the Russian kingdom, in 862 put himself at the head of the Slavs in Novgorod, and conquered (together with his brothers) the whole of the district from Novgorod to what is now LITTLE RUSSIA. On the death of his brothers he united the country under the name of Russia. He died in 879.

Rush, the popular name for members of the genus *Juncus*, the type of the monocotyledonous order Juncaceæ, extended also to a few related or similar plants. There are about 100 species in the genus, mostly natives of temperate and arctic regions, 20 being British. They grow mostly in wet ground or in water, with cylindric leaves and branches and green or brown flowers in a dense cluster known as an anthela (q.v.). The flowers have six glumaceous perianth-leaves and six stamens, and are succeeded by a three-chambered, many-seeded capsule. *J. conglomeratus*, *J. acutus*, and others are used for chair-bottoms, baskets, hassocks, and mats, several hundred tons being imported annually, mostly from Holland. The stellate parenchyma or so-called "pith" in the centre of the branches and leaves of some species used to be employed as candle-wicks, and in still earlier times stone floors were strewn with rushes in lieu of carpets.

Ruskin, JOHN (b. 1819), is the son of a merchant, and was born in London. He was educated privately and at Christ Church, Oxford, graduating in due course and carrying off the Newdegate prize. His love of art found expression in his early attempts at painting and in the pamphlet written by him in defence of Turner and his method, which was afterwards expanded into the great work, *Modern Painters*, the five volumes of which, illustrated by himself, appeared between 1843 and 1860. His views found general favour, and his beautiful style and poetical diction gained him great applause, but several critics severely criticised his opinions. Previous to publishing his second volume he had visited Italy, and some of his finest works are due to that visit. In 1849 appeared his *Seven Lamps of Architecture*, which was followed by *The Stones of Venice* (1851-53), a work illustrated by some of his own drawings, *Lectures on Art* (1859), *Unto this Last* (1862), *Ethics of the Dust* and *Sesame and Lilies* (1865), *Crown of Wild Olive* (1866), *Aratra Penteliei* (1872), *Val D'Arno* (1875), and others of equal note. These were mostly reprints of lectures delivered by him with great success at Oxford and Cambridge. He was Slade Professor of Art at his own university and Rede Lecturer at Cambridge, of which he was made an honorary LL.D. in 1867. So many students attended his Slade lectures that he was obliged to deliver each one twice. He finally resigned the post in 1884. His autobiography, under the name of *Praterita*, began to appear in parts a few years ago, and in 1893 his *Poems* were published, while various books have

been written concerning him, most important of which is that by Mr. W. G. Collingwood.

Russell, LORD JOHN, afterwards EARL RUSSELL (1792-1878), statesman, was the youngest son of the Duke of Bedford, and was born in London. In 1813 he entered Parliament as M.P. for Tavistock, afterwards becoming member for Huntingdon. He was an ardent Liberal, and for many years pressed forward various schemes of reform, which were invariably rejected. He published, in 1819, a *Life of Lord William Russell*, and during the rest of his life continued his contributions to literature. He first obtained office in 1830 as Paymaster of the Forces. The Reform Bill of 1832 was largely the result of his persistent advocacy, and he was at that time asked to form a ministry, but failed. In 1835 he became M.P. for Stroud, and in 1841 was elected to represent the City of London. He was appointed Home Secretary soon after his election for Stroud, and between 1839 and 1841 was Secretary for War. He aided in the repeal of the Corn Laws, and in 1846 attained the office of Prime Minister, which he held till 1852. In 1861 he was raised to the peerage, and in 1865, after the death of Palmerston, he was again Premier, but only for a year. He was a consistent Liberal, but not a strong Minister. As an author he is chiefly known by his *Memoirs of Thomas Moore* and his *Life and Times of C. J. Fox*.

Russell, WILLIAM LORD (1639-83), son of the first Duke of Bedford, was a member of Charles II.'s Privy Council, and resigned owing to the recall of the Duke of York and what he conceived to be the consequent probable re-establishment of Popery. He brought the matter before the House of Commons, and its action caused the king to dissolve it and to act arbitrarily in other ways. A serious conspiracy followed, and Lord Russell was certainly one of its promoters, but he was tried for complicity in the Rye House Plot to assassinate the king, and was executed on July 21st, 1683. His courage and intense love of liberty endeared him to the people. After the Revolution the attainder against him was annulled. His wife, RACHEL, who lived till 1723, was a noble woman, whose beautiful character is clearly exhibited in her *Letters*.

Russell, W. CLARK (b. 1844), is the son of Henry Russell, the veteran composer, and served as a midshipman in early life for several years. His novels, which are chiefly nautical, commenced to appear in 1874, and are exceedingly and deservedly popular. They include *The Wreck of the "Grosvenor,"* *An Ocean Free Lance*, *The Golden Hope*, *Marooned*, *A Frozen Pirate*, and *Jack's Courtship*.

Russia. *Physical Aspects.* The vast extent of the Russian Empire is a favourite theme of the geographers. The British Empire alone, in modern or ancient times, has outmatched its prodigious bulk. Stretching across the north of Europe and Asia—from the Baltic and the borders of Sweden, Prussia, Austria, and Roumania in the W. to Behring Strait and the Seas of Okhotsk and Japan in the E.—and from the Arctic Ocean to the Black Sea, Asiatic Turkey, Persia, Afghanistan, Eastern

Turkestan, and China in the S., it has an area (nearly 9 million square miles) equal, as the present Emperor once boasted, to one-sixth part of the land-surface of the globe. Its physical characteristics are in proportion, with two important exceptions. It has few mountains, and these only on its borderlands—in the Caucasus and in Central and Eastern Asia. In deference to custom we treat Asiatic Russia separately [SIBERIA], but Nature makes no such distinction. The Urals, a line of low rounded ridges, the highest summits of which are only 3,932 ft. and 4,875 ft., and through which a railway is easily carried, do not constitute a natural frontier, and in no way interrupt the fauna and flora of the vast plains which roll eastward and westward from them. In the second place, European Russia has, in proportion to her bulk, a very small coast-line, and even of this little all the northern parts are ice-bound for the greater part of the year. Even the northern Black Sea ports are frozen in winter, and in the Baltic, Libau alone is almost always open. [PETERSBURG, RIGA, ODESSA; WHITE SEA, BALTIC, BLACK SEA, CASPIAN.] Lacking mountains and valleys, coast-line, and a Gulf Stream, Russia lacks most of the climatic influences as well as the scenic effects which the smaller countries of Europe enjoy. Apart from the regular seasonal changes, there is a likeness of condition in her various latitudes—from the land of the reindeer to that of the camel—which gives some ground for the declaration that Russia was "created for unity." Almost everywhere the extremes of heat in summer and cold in winter are experienced. The west and south winds avail little against those of the icy north and the arid east; and their burden of moisture is soon lost. There is but a small rainfall. Only in the Southern Crimea and beneath the towering bulwark of the Caucasus (q.v.) is there a southern climate as we understand it. The sudden break-up of the long winter frost in a short raw unpleasant spring has given native poets one of their best subjects. Hardly less striking is the sudden lapse into the idle indoor life of winter, with doors and windows hermetically sealed and the great stove ever hot; or the sleighing, the sport, the skates, and the ice-hills.

Setting apart the moss-covered deserts or *tundras* of the far north, where the few half-savage hunters and fishermen [SAMOYEDS] maintain a precarious existence, two natural regions differentiate themselves amid the general uniformity of the landscape, giving a key to racial differences and the historical developments we have presently to trace. The northern and slightly larger zone, that of the forests and lakes, extends from the 65th southward to the 53rd degree of latitude—say, from Archangel to Kieff. Immense forests, mainly of birch, pine, and

fir, spring out of the boggy and occasionally sandy, always comparatively sterile, plain. The overplus of water gathers itself into broad marshes, rivers, and lakes varying in size from the eleven hundred of Archangel to Ladoga and Onega, the largest in Europe. Here is the only noticeable elevation of the central plateau, the Valdai Hills, where the Volga and other great southern rivers rise.



MAP OF RUSSIA.

[DWINA, WESTERN and NORTHERN.] Throughout this region agriculture is pursued among most unpromising conditions, and only in the few industrial centres, especially about Moscow and the mines of the Ural, is there any concentration of population or growth of prosperity.

The second zone, that of the Steppes (q.v.), occupies the southern half of the country, broadening as it sweeps eastward into the still drearier plains of Asia. Through its interminable prairies the great rivers pursue their unbroken and unlovely course, carrying the needed wood and water of the north in exchange for the grain of the south. [VOLGA, DNIÉPER, DNIESTER, DON, URAL.] The network of canals which joins many of the Russian

rivers completes the list of the magnificent waterways which are her great compensation for her isolated position and climatic disadvantages. Over the upper part of this zone, treeless as it is, in the north by man's extravagant folly and in the south by nature's parsimony, there lies a rich soil, the famous *chernoziom* or black mould, which makes it pre-eminently the granary of Europe. In the south this rich belt merges first into the fertile steppe, a virgin prairie covering another three or four hundred thousand square miles in the Cossack country and along the lower course of the great rivers, and then into the barren sandy or saline wastes of the Uralo-Caspian depression.

History. The making of the Russian State began, no doubt, in the belligerent impulses which brought Scandinavian freebooters down upon all Europe about the same time (Finnish, *Ruotsi*; *Rothsmenn* or *orothskarler*—"rovers," "seafarers"). It proceeded afterwards from the natural exigencies of the situation. A glance at the ethnographical map of Russia in the 9th century shows that of the three main racial groups [SLAVS, FINNO-TATARS, TURKS], the barbarians of Turanian stock occupied by far the greater part of the country. Across the whole north were the Finnish tribes; in the east, the centre, and nearly the whole of the south Finns and Turks mixed; and south-east of the Volga and the Urals more Turks, especially Bashkirs (q.v.) and Khazars. These last, the most powerful and civilised of these peoples, then masters of the Steppes, though troublesome themselves, proved to be the best rampart against the mountaineers and Greeks of the south, and at a later time against the Tatars, Mongols, Kirgiz, and Kalmuks (q.v.) of the east. On the other hand, the Slavs spread down the west-centre from Novgorod to Kiev and the mouth of the Dnieper, and westward thence into Poland and Pomerania, having Lithuanians (q.v.) as neighbours on the middle Baltic coast. These peaceful Slavs of the north-west already had some cities, notably Novgorod (q.v.), Kieff (q.v.), and Pskof, the first-named already an important commercial centre, but were otherwise living in a simple agrarian communism. Either as mere robbers or invaders, or, if we follow the oldest Russ tradition, by invitation to protect the native Slavs from the outer barbarian and to settle their internal differences (very much as Hengist and Horsa came to Britain), there came to Novgorod in 862 Rurik (q.v.) and several other Varangian adventurers, into whose commissions he soon entered. The monarchy Rurik founded had at first a minimum of organisation and authority, but Oleg, the guardian of his son, was strong enough to capture Kiev, to reduce all the Slav tribes to the mouth of the Dnieper, and even to successfully assault Byzantium (q.v.) itself. The Greeks had their revenge for this indignity. Olga, the militant widow of Igor and the first of many striking female figures in Russian history, went to Constantinople in 955, and was there baptised as a Christian. Two generations later Vladimir, after deliberately examining Islamism, Judaism, and the Latin and Greek forms of Christianity, chose to adopt the last. Thus, without difficulty or disturbance, Byzantinism, with all it implied—alphabet,

ideas of civil government, all the main features of Greek civilisation—was accepted by the Eastern, as Romanism had already been accepted by the Western, Slavs, a division which was to be the cause of endless strife in succeeding centuries. By his marriage with the sister of the Byzantine emperor, Vladimir sealed this destiny, at the same time making himself a more powerful and imposing figure. His son Yaroslav, "The Wise," did various peaceful works, of which the first Russian code of law is the most important.

The Scandinavian adventurers, having done their pioneering work, having founded a military state upon the important commercial line from the Baltic to the Black Sea and the Bosphorus, were quickly lost in the all-absorbing Slavic environment. A period of active colonisation was now opening, and the danger was that unity would go with the simple military rule they had established. Under the system of multiple-heritage there grew up during the two centuries after the death of Yaroslav (1054) over sixty great and little principalities, *appanages*, which had in that time nearly three hundred sovereigns. In this period the old primary liberties and privileges were generally maintained, the principalities being really free republics, the princes soldiers of fortune, easily attracted and easily removed, interfering but little with the power in local affairs of the *mir* and *vetche*. Slavery existed, however, and the class of *boyars* (nobles) was becoming an important social unit with which both prince and people must reckon. For a time the elder princes, the grand-kniazes of the line of Vladimir and Yaroslav, kept their moral superiority, thanks to their special ecclesiastical sanctions, their foreign relationships, and the close connection between their grand capital, Kiev, and Byzantium, some of whose fading glory she temporarily caught; but this supremacy did not last. Colonisation proceeded steadily on the north and east. On this harder soil, with more mixed racial elements—half-Slav, half-Finnish—the princes had a freer scope. Feuds multiplied, and the next generations saw much bloodshed, the princes fighting for their own hands here much as the feudal barons in the West. Gradually the elder-brotherly authority was thrown off. In the middle of the 12th century a prince of Suzdal took the title of Grand-Kniaz, and then proceeded to attack and pillage Kiev, which forthwith lost its old supremacy. In 1224, four years after the foundation of Nizhni (or Lower) Novgorod, there came upon the scene a new force which was to turn with violent hand the whole destiny of the country.

There were really three contemporary invasions, not one only; but two of these we can barely mention. On the north-west the Teutonic Knights (q.v.) and the Sword-bearers, two orders of northern crusaders, in subjecting the heathen tribes of Prussia and Lithuania and the Finns of Livonia and Esthonia to German rule, reducing them at once to Christianity and servitude, impinged seriously upon Polotsk, Novgorod, and Pskof. Later on a Lithuanian chief, Guedimin (1315–40), was able to stop the Teuton incursions and, by repeated conquests among the chaotic Russian principalities,

to lay the foundation of that Lithuanian principality which, becoming unified later on with the independently-founded Polish state, ultimately extended from the Baltic to the Black Sea, covering all White and Little Russia and effectively cutting off the Slavs of the forest region from civilised Europe.

But the Mongol-Tatar invasion is the cardinal fact of Russian history. This was the northern edge of that vast crescent-shaped wave of Ottoman frenzy which had swept victoriously round the eastern and southern Mediterranean, and which—while the West Christian barons were plundering the Eastern Empire instead of carrying out their precious Fourth Crusade—was preparing a still fuller revenge for the past aggressions of Roman and Byzantine Emperors. Zinghis Khan (q.v.), already conqueror of Northern China, Afghanistan, part of India, and Persia, sent an expedition to reduce the tribes around the Caspian. The Tatar forces were attacked (1224) by the combined Russian princes, but after a temporary check were completely victorious. During a thirteen years' respite the Russian princes learned nothing. Then the Tatars reappeared in enormous numbers, swept away the Finnish Bulgars of the Volga, overran Riazan, Moscow, and Vladimir, burning and massacring everywhere. Kief was destroyed; Galicia and Volhynia were devastated; Silesia was overrun, and for the moment even Rome and Germany were threatened. The invaders pressed far into the north. Novgorod alone, then at the height of its prosperity, was spared, but had to pay tribute. [ALEXANDER NEVSKOI.] The Khans of the Great Horde, from their new city of Sarai, forced all the southern and eastern princes to offer homage in person and then to pay poll-tax to duly-commissioned agents, the prince being held directly responsible. Every insubordination was terribly punished. The notable thing, however, is that the subject races were left their social structure, especially their religion, which thus became identified with all patriotic hopes and efforts. The next century is full of squalid evidence of the utter demoralisation of the Russian princes. Moscow, hitherto a mere village, innocent of the old Slavic liberties, customs, and traditions, now began to rise into importance, mainly by providing the ablest, most subservient, and most unscrupulous agents to the Mongol Khans. By this connection and by intermarriage the Muscovite nobility became partly Tatarised, and the Oriental element already introduced through Byzantium was revived and intensified. The use of the knout and the *plet* began at this time. The former was only abolished under Nicholas (1845), while the latter has survived until more recent years. By securing the removal to Moscow of the religious authority and by getting himself appointed general collector of tribute, Ivan I. (died 1340) managed to greatly strengthen and extend the new state. It was not till after another century, during which there was an outburst against the Mongols under Dimitri Donskoï and another bloody vengeance, that the long tyranny may be considered to have come to an end. In 1478—the interval being filled by constant struggles for the princely

succession—Ivan III., the Great, forcibly annexed not only Viatka, Tver, and other principalities, but also Novgorod, which never recovered its unique position as a trade centre. Ivan endeavoured to check disintegrating tendencies by ending the system of divided sovereignties and by increasing the power of the grand-kniaz as against the petty princes and boyars. He also defeated the Lithuanians, and, finally turning against the now divided khans, routed them and so threw off the crushing yoke of 240 years. The Mongols were often troublesome afterwards, but they never again threatened the integrity of the empire. The extent of the influence of their cruel domination upon the heretofore mild and generous spirit of the pastoral Slavs is a difficult and delicate question; but its main direction cannot be doubted, and its depth is testified still, after the lapse of four centuries, by the survival of their double legacy, a united Russia under an absolute despotism.

We are now to see the rapid growth of the sovereign power and the proportions of the state. The fall of the Eastern Empire opportunely suggested a new set of pretensions to the ambitious Muscovites, pretensions which fell in admirably with the idea of a monarchy supreme in Church and State. Ivan III. had married the niece of the last Greek Emperor, and had assumed the imperial arms, the double eagle. The title of Tsar (Cæsar) was fully adopted by Ivan IV., the Terrible. The extraordinary career of this ruler—recalling now Nero, now Louis XI., and again our own Henry VIII.—has already been briefly summarised. His unspeakable cruelties, his treachery and superstition, make his name a byword; but it is to be said for him that under his rule the power of the boyars was still further curtailed; the civil code revised, and an ecclesiastical code laid down; the bounds of the empire extended by conquest especially on the east and south, the Mussulman kingdoms of Kazan and Astrakan and the native tribes of the Volga and Don being conquered; the colonisation of Siberia begun under the Cossack Yermak; English and other foreign traders welcomed; and the arts encouraged in a small way. Ere any further considerable national development could occur, it was necessary to win a place upon the Baltic and the Black Sea, and so to open communications with the west and south. But these ways were blocked, the one by Sweden and Poland and the other by the Turks and the Free Cossacks of the south. Nothing could seem more improbable than any achievement in these directions during the veritable "period of troubles," as the Russian historians call it, which makes up the greater part of the 17th century. The episode of the false Demetrius (q.v.) reminds us of our own Perkin Warbeck just a century earlier. The fraud assumed larger proportions, however, by reason of the deeper ignorance of the Russian people, the more complete isolation of their communities, and, still more perhaps, the selfish designs of native and foreign princes, and the anxiety, especially at the Polish Court, to bring Russia into the Latin communion. Boris Gudonof, regent for Theodor and himself Tsar after the murder of the true Dimitri, is

mainly noteworthy as the practical founder of serfdom by his temporary measure, afterwards to become permanent, attaching the too-nomadic peasant to the soil. The Polish invasion was temporarily successful, and for a time the country was overrun by Poles, Swedes, Cossacks, Tatars, and other marauders. The rally under the first Romanoff Tsar, Michael, elected and supported by a national council (*Sobor*) in 1613, shows how persistent was the Russian national feeling and the hold of the Orthodox faith. For a time the influence of the nobles revived, and there was a growth of Western influences. Under Alexis the precursor of Peter, further progress was made, although the condition of the peasants was so desperate that they were driven into repeated revolts. In this reign the Dnieper Cossacks transferred their allegiance from Poland to Russia, securing by compact, however, their autonomy, and the innovations of the patriarch Nikon, which were regarded as arbitrary, caused the great religious disruption to which the chief Dissenting sects (*raskolniks*) trace their origin.

Peter the Great (q.v.) opened the third, which may be called the European, period of Russian history. It is impossible here to do justice to his reign. He made his country a European state. He gave her a standing army, a navy on the Baltic, the embryo of a modern administration, a diplomatic service, and a financial organisation. He made canals, encouraged industry, literature, and art. The heart of Russia might remain at Moscow, but henceforth it was to have also a head that looked out westward from the Neva. On the other hand, Peter increased taxation; his cruelty was Oriental, and serfdom under him became more and more extensive. The Court annals of the next century present an extraordinary succession of foreign adventurers, female rulers, palace plots, exiles, vulgar orgies, crimes of violence, and all manner of baseness. [MENSCHIKOFF.] Anna (q.v.) (1730-40) gave the unhappy country up to her German favourites. A second attempt (counting the charter between the *Sobor* and Michael Romanoff as the first) to obtain a constitution failed at her accession. Under Elizabeth the southern part of Finland was obtained from Sweden by treaty; and in the Seven Years' War (q.v.) Russia came into contact with Prussia under Frederick the Great. In internal politics this reign is noted for the growing oppressiveness of serfdom. In the milder reign of Peter III. German influences revived; this, his confiscation of Church property, and his severe military discipline, led to his downfall. Catherine II. conquered and annexed the whole Crimea and the seaboard between the Bug and Dniester, Russian fleets now appearing for the first time in the Mediterranean. In the three partitions of Poland [POLAND, SUVAROF, KOSCIUSKO], in 1772, 1793, 1795, Russia obtained two-thirds of that country, together with the province of Courland, so that the whole Baltic provinces [CURLAND, PETERSBURG, LIVONIA, ESTHONIA] were now Russian. The pretender Pugachev raised a fierce agrarian *jacquerie* (1773), but the victories of Michelson broke his forces, and with his capture the revolt ended.

Catherine, although reactionary at the end of her reign, carried on many of Peter's reforms, and thoroughly established Russia as a European power. To her, however, the Ukraine owes its serfdom, as also very heavy burdens in taxation and in the increase of the arbitrary power of the serf-holders. Paul was eccentric to the point of insanity. He established a severe press censorship, reorganised the secret police, settled the succession on the sovereign's eldest son, was now a *pro*- and then an *anti*-Bonapartist, and was assassinated in 1801. Alexander I. (q.v.) renewed the friendship with England, joined the third coalition against Napoleon, and—the tempting prospect of a Franco-Russian partition of Europe opened out at Tilsit (q.v.) having faded away—was again compelled to withstand the conqueror of Austria and Prussia. [NAPOLEON.] Two years after the occupation of Moscow the Russians stood with the Allies in Paris. The jealousy of the Allies prevented Alexander from taking the whole of Poland. Meanwhile Georgia (q.v.) and nearly the whole of the Circassian provinces had been incorporated, Finland (q.v.) with the greater part of Bothnia ceded by Sweden in 1809, and Bessarabia (q.v.) taken from Turkey in 1812. The various reactionary measures of Alexander's later years provoked much discontent, which at his death culminated in a third futile effort to obtain a constitution. [DECEMBRISTS.] Nicholas made no pretence of satisfying the demands of reform; but in the rôle of liberator of the faithful in the south he joined the Allies in securing Greek independence, and by further aggression in Turkey got more territory on the east coast of the Black Sea and the left bank of the Danube and became protector of Moldavia and Wallachia. A protectorate was imposed upon Khiva, and the Kirghiz submitted. In Siberia the far eastern seaboard was now reached. In the next reign Turkestan was conquered; Khiva, Khokan, and Samarkand were annexed; and Bokhara became a vassal state.

Thus we see completed the Slavic revenge for the Mongol invasion. It is impossible here to indicate the full ethnological significance of these long centuries of colonisation and absorption; but the separate articles on SLAVS, FINNISH TRIBES, MONGOLS, TATARS, COSSACKS, POLES, CAUCASIANS, etc., should be consulted. The Great Russians have become the backbone of the nation, constituting nearly half of the total population of the empire and occupying all the central part of European Russia from the White Sea to a line roughly drawn from Smolensk to the point where the Don most nearly approaches the Volga. Little and White Russians [UKRAINE] to the number of 15 millions share the west-centre with Lithuanians (q.v.) on the Baltic shore to the north and Poles on their west. On the south-east are the Turkotatar races—Kalmuks, Bashkirs, and Kirghiz (q.v.). In Lapland, Finland, and the North Ural region are the Finnish races. Scattered about are colonies of Jews, Germans, Swedes, and Southern Slavs.

The futile insurrection of the Poles in 1830-31 led to the revocation of all their liberties. Nicholas now aided Turkey against the Khedive and Austria

against the Magyars, this last action depriving him of the sympathy of Western Europe. The campaign against Turkey, which ended in the Crimean War (q.v.), brought Russia great loss and bitter disappointment. Nicholas died before it ended. It seemed at first that by timely measures of reform Alexander II. (q.v.), a well-meaning but weak ruler, would restore the shaken confidence of his people. The emancipation of 23 millions of serfs in 1861 is the great measure of the reign and indeed of the century. The land of nearly half the peasantry (the other half, the already "free" Crown peasants, were differently treated) was handed over to the village communities (*mir*), subject to a payment for 49 years of redemption dues of 6 per cent. on the amount of the purchase money. The 1½ millions of domestic serfs simply got their liberty. Unfortunately, Alexander, wanting to satisfy everybody and fearful of the work into which necessity had driven him, entrusted the scheme to alien and unfriendly hands. Its operation has been very uneven; and the price paid is often far greater than the value of the land. Alexander III. abolished the old poll-tax in 1886, and has in some places reduced the redemption dues; but the burden of taxes and dues is still excessive and in some forms is constantly increasing, and the condition of the peasantry is generally so wretched that they fall an easy prey to the famines and epidemics of cholera and other diseases which have devastated the country in recent years.

The second Polish insurrection (1863) was mainly responsible for the backward turn of the Tsar-Liberator's policy. For a time the crusade against the Turks (1876-8) [TURKEY, BALKANS, SKOBELEF] drew attention away from domestic affairs; but the victorious issue brought Russia nothing more than Bessarabia, a part of Armenia, and a fuller conviction of the corruption and incompetence of her administration. From this time dates the active revolutionary movement misnamed Nihilism. In its first period, under the inspiration of Herzen, Bakunin in his rational period, and Tchernishevski, it took the form of a secret propaganda with the object of securing freedom of speech and press, public justice, personal security, the abolition of administrative exile, and the calling of a national assembly. In 1878 the propagandists were driven into a terrorist policy, which culminated in the assassination of the Tsar in 1881. The vengeance of the Government was swift and terrible. Thousands of persons were arrested and imprisoned or exiled without trial. The struggle continued for some time, and then the revolutionary parties subsided again into a policy of propaganda and preparation. Some of their leaders, notably Sergius Stepniak, Felix Volkhovsky and Prince Peter Krapotkin, having escaped from prison or exile, are endeavouring by a foreign propaganda to sap the external resources of the autocracy; and quite a literature is now devoted to the shocking condition of Russian prisons, the brutal treatment of the prisoners, the corruption of the administration, the persecutions of Jews and Stundists (q.v.), the horrors of Siberian exile, and the absence of all public and private liberty. Within the empire

there have lately been university riots, peasant disturbances, sedition in the army, and labour strikes. Famine and financial embarrassments have had even a greater effect in hastening the crisis which seems inevitable.

Government and Institutions. The Russian Government is a pure autocracy (sometimes miscalled paternal) with a hereditary succession, the emperor being also supreme head of the Orthodox Russian Church. There is no constitution in our sense, no parliament, no responsible ministers. The Tsar is aided by a Holy Synod of eight prelates and a Procuror-General, by ten independent ministries, a Department of General Control, an advisory Council of the Empire, and a Senate which has practically become a high court of justice. "Laws" in Russia simply mean decrees of the emperor. Judicial procedure is in a very backward state, and the criminal system is full of anomalies and inhumanities. Some concessions to the demand for reform have lately been cancelled; the *Zemstvos* or local boards have, for instance, been reduced to complete impotence, and the elective justices of the peace replaced by police officers appointed by the Crown (*Zemski natchalniki*). Autocracy penetrates almost to the bottom of the social structure. The bureaucracy is elaborately divided into 40 ranks (*tchin*). The nobles have never as a class had the power which feudalism gave their fellows in the West, and Russia has perhaps lost as much as she has gained by having no political aristocracy. Military service was made obligatory in 1874. The *army* numbers, on a peace footing, about 800,000, but it is calculated that 5½ millions of men could be called to arms. The *navy* has grown rapidly in late years. The clergy are black (regular) or white (secular), the parish *popes* being of the latter class. There are, besides the Orthodox Church [GREEK CHURCH], many *religious* sects. The Finnish, German, and Swedish Protestants, the Polish and Lithuanian Romanists, the few Uniates of White Russia, and the Tatar, Bashkir, and Kirghiz Mohammedans, enjoy full liberty of worship, but not of preaching or proselytism. The various bodies of Dissenters sprung from orthodoxy have hardly ever had more than a varying degree of toleration; of late the Government policy towards some of these and the Jews has changed for the worse, and active persecution has lately caused much suffering, especially among the Stundists. There is a sort of petty commercial nobility and at the bottom the peasantry with their ancient *mir*, the only relic of the original Slavic democracies. *Education* is far in arrear, being harassed by constant arbitrary interference in the supposed interests of the state, and a stern press censorship is maintained.

Literature and the Arts. Apart from the *bilini* or poetical folk-tales of legendary and historic heroes, the early proverbs and love songs, and a single surviving poem of the twelfth century narrating the expedition of Igor against the Polovtsi, there is little of popular interest in Russian literature till the time of the national revival under Peter I. Then Lomonosof (1711-65), poet, grammarian, and scientist, though a narrow chauvinist

and coarse like most of his contemporaries, gave a new impulse to native thought. For a time, however, nothing better than Court poetry resulted. Through the solemn bombast of Derzhavin (1743-1816) and the German romanticism of Zhukovsky (1783-1852), we come to the period of Pushkin (q.v.) and Gogol (q.v.). In Pushkin the many-sided poetic spirit of the Slav finds free and vigorous utterance. Lermontof (1814-41) breathed in, during his repeated exiles to the Caucasus, a vaster inspiration, and came more nearly to the height of Byron's achievement. Gogol, turning his back upon romanticism, brought to bear in *The Revisor* and *Dead Souls*, the scourge of his wit and a scathing satire upon the hollow society about him. Karamsin (1765-1826) is remembered not only as the great modern historian of Russia, but as a literary forerunner of the Slavophil or Panslavist school, of which Aksakof and Katkof (q.v.) were the moving spirits. Solovief (1829-79) and Kostomarov are the next great historians. Krilof's fables are widely known. Bielinsky (1801-48) proclaimed a return to realism; and Dostoieffsky (q.v.) (1822-81) with tragic intensity and Tourgenief (q.v.) (1818-83) with more classic art and a soberer philosophy have worked in the same spirit in fiction, as Nekrasof in poetry and Verestchagin, Hay, and Repin in painting, producing many sombre and harrowing pictures as well as some bright ones of the life of their countrymen. Count Leo Tolstoi (q.v.) has pushed even farther the analysis of the human soul, measuring its every weakness by the inexorable standard of an ascetic Christianity. Goncharov pointed out to the Russians in his *Oblomov* one of their chief weaknesses. Shevchenko (1814-61), the greatest poet of Little Russia, suffered bitterly at the hands of those in authority, as most of the intellectual leaders we have named have done. Schedrin's social satires and the grim realism of the unhappy Garshin must be mentioned, while among living novelists Korolenko and Potapenko are now well represented in English. As to the very characteristic music of Russia we can do no more than refer the reader to the separate notices of RUBINSTEIN and TCHAIKOVSKY. In science Mendelief the chemist, Kovalevsky and Metchnikof the comparative embryologists, Chebychef the mathematician, Krapotkin the geographer and mathematician, have international reputations, and Paul Vinogradoff has done as much as any living man to clear up the early history of land-tenures, especially in England.

Rust. Most metals, if exposed to the air, become covered with a superficial coating, consisting of the oxide of the metal. This oxide is commonly known as *rust*, but is used more frequently in regard to the rust of iron than that of other metals. Iron rust was distinguished in classical times and employed medicinally. Until the overthrow of the phlogiston theory [PHLOGISTON] the chemical nature of rusts was unknown, and they were regarded as the element, the metal being considered a compound of the rust and phlogiston. Although most metals rust if exposed to the atmosphere, it is noticeable and interesting that none do

so in *perfectly* dry air or oxygen, the presence of a small quantity of aqueous vapour being essential.

Ruth, BOOK OF, is in the Canon of the Christian Bible, and holds a high place in the estimation of the Jews. Its author is unknown, and its date uncertain, apparently not later than the period of the kings.

Ruthenian, collective name of the so-called "Little Russians," a main branch of the Russian Slavs, who form the bulk of the population in Ukrania (South-West Russia), Galicia, and the Carpathians, numbering altogether about 20,000,000. The Ruthenians are quite distinct both in physique, mental qualities, and speech from the "Great Russians," or Russians proper, and are regarded as a much purer division of the Slav family. They are taller, with more slender figures and more regular features, and more animated, but also less resolute expression, and more poetic temperament. In recent years the Russian Government has made strenuous, but hitherto unsuccessful, efforts to efface all the differences between the two groups, especially by forcibly substituting the Great Russian for the Little Russian dialect in the educational establishments of Ukrania. Austria contains over 3,000,000 Ruthenians, Hungary nearly 400,000, and there is a "Ruthenian group" in the Austrian Reichsrath.

Ruthenium (RU 103·6), a rare metallic element which occurs to a small extent associated with platinum and its allied metals. It is a steel-grey, brittle metal, specific gravity 11·3, which is very infusible and is insoluble in acids. In its chemical characters it closely resembles the other metals of its class, *e.g.* osmium, platinum.

Rutherford, SAMUEL (1600?-61), Scotch divine, was born in Roxburghshire, and educated at Edinburgh University. In 1627 he was appointed minister of Anweth, in Kirkcudbright, where he laboured with great zeal and piety. His preaching was impressive, and he became deeply beloved, but his views were not considered sound, and the bishops, in 1636, ordered him to confine himself to Aberdeen, a virtual exile. He was restored to his people in 1638 amid their rejoicings, but soon after accepted a professorship of divinity at St. Andrew's, of which he became Rector. In 1643 he published his *Lex Rex*, an able protest against the theory of the divine right of kings. In 1644 appeared his *Divine Right of Presbytery*, a learned work, which Milton and others attacked. After the Restoration his *Lex Rex* was publicly burnt, and he was deprived of office and ordered to answer the charge of high treason, but died before his trial. His name is still held in reverence in Scotland.

Rutile is a crystalline form of *titanium dioxide* (TiO_2), a substance remarkable for being trimorphous, *i.e.* crystallising in three distinct forms—viz. *rutile*, *anatase*, and *brookite*. Of these forms rutile is the commonest, and exists as brown lustrous crystals of the Quadratic system possessing a specific gravity of 4·2. It frequently occurs in igneous rocks, *e.g.* granite, and also in hard limestones. [ANATASE, BROOKITE, TITANIUM.]

Rutland, between Lincoln, Leicester, and Northampton counties, is the smallest county of England, and contains 49,889 acres, nearly all under cultivation and pasture. Wheat and barley are grown, and many oxen and sheep reared. There are 3,000 acres of wood and plantation. The W. part is mostly grass, the E. under tillage. Excellent cheese is made. The principal towns are Oakham and Uppingham.

Ruysdael, JACOB (1625?-82), Dutch painter, of whose life little is known. He was born at Haarlem, and studied medicine, but turned to art, and was a pupil of Berchem at Amsterdam. He, in turn, was probably the master of Hobbema. His pictures are mostly landscapes, and he excelled in painting wooded scenes and waterfalls, the figures being generally added by other painters. He is very well represented in the National Gallery.

Ruyter, MICHAEL ADRIAN DE (1607-76), famous Dutch admiral, was born at Flushing, and entered the navy at an early age. His gallantry and skill gained him a speedy promotion, and he did not fail to take advantage of his opportunities of distinguishing himself against the English on the sea. He commanded with Van Tromp the fleet which, in February, 1653, fought the great engagement with Admiral Blake at the Channel's mouth. In 1666 he repulsed Prince Rupert and Monk, but was himself beaten a little later by them. In the following year he managed to sail up the Thames to Sheerness, where he destroyed some men-of-war. In a battle with the French off Messina he was wounded, and died at the port of Syracuse of the effects. His body was buried at Rotterdam.

Rye, a decayed municipal borough of Sussex, and a Cinque Port, is 64 miles S.E. of London, at the mouth of the Rother. In 1885 its Parliamentary representation was transferred to the "Rye division" of the county. It was once walled, and some gatehouses still remain. Its church bears witness to its former greatness. There are iron- and chemical-works, brewing, ship-building, and a trade in corn, coal, hops, wool, timber, and oak-bark. Rye takes part in the herring and mackerel fisheries.

Rye (*Secale cereale*), a cereal grass, probably native to South-Eastern Europe, the flour of which forms the black bread which is the staple food of most of Northern Europe. It is still cultivated to a small extent in our eastern counties, but mainly as green fodder. Its grain is imported for malting. In structure it nearly approaches wheat, but differs in having two flowers and a stalked rudiment of a third in each of its spikelets. It is peculiarly liable to the attacks of the fungus ergot (q.v.), which is known in pharmacy as *Secale cornutum* or "horned rye."

Rye-Grass (*Lolium perenne* and its variety, *L. italicum*) is one of the most valuable fodder-grasses cultivated in Britain, either in permanent pasture or as a rotation crop. Four crops may be obtained in the year, the first being ready to cut in April, and in sewage-farming the weights of hay

which it yields are very great. Its inflorescence consists of a flat compound spike, the spikelets, which overlap, being placed edgewise along the rachis. Each spikelet contains three or more flowers.

Rye House Plot, THE, was formed in 1683, and had for its object the assassination of Charles II. and James, Duke of York, on their return from the Newmarket races. Its object was defeated, but its instigator, Colonel Walcot, was executed, as were Lord William Russell and Algernon Sidney, who were accused of being implicated in the movement of which it was part. Lord Essex escaped the block by suicide.

Ryswick, PEACE OF, concluded in 1697 at the town of Ryswick, ended the war between Louis XIV. against Great Britain, Holland, Spain, and Germany. Louis acknowledged William III. as King of England, restored what he had taken from Germany, with the exception of Alsace and Strasburg, and gave up to Spain his conquests in Catalonia and the Netherlands.

S.

S, the 19th letter in the English alphabet, and the last but one in the Phœnician, from which it passed to the Greek. It has a sharp hissing sound, which is sometimes represented by *ss* or *c*, and a soft sound also, represented by *z*. As the teeth and tongue are both employed in its production, it is classed sometimes as a dental, sometimes as a lingual, and is also called a semi-vowel. In German it is generally soft at the beginning of a word, and hard at the middle or end, the English use being, for the most part, the reverse of this. Many Latin words with initial *s* in passing into French acquire the prefix *e*, as *spatium*, *espace*; and the *s* is often dropped entirely, e.g. *statum*, *état*. Attic Greek preferred *t* to *s*, e.g. *thalatta* for *thalassa*, etc., and in many cases the lispings *th* is substituted for *s*. Some South Sea islanders are unable to pronounce *s*.

Saale, the name of several German rivers, the most important being the Thuringian Saale, which rises in the Fichtelgebirge, in Northern Bavaria, and flows N., joining the Elbe near Magdeburg. It has a course of 226 miles.

Sabadilla Seeds are the winged seeds of *Asagraea officinalis*, the only species of a Mexican genus of Colchicaceæ. It is a bulbous plant, with long narrow leaves, an ebracteate raceme of flowers, and a fruit of three many-seeded follicles. The seeds were formerly used to destroy vermin, but are now only used as a source of the poisonous alkaloid *veratria*, $C_{52}H_{86}N_2O_{15}$. About 175 tons are shipped annually from Caracas, mostly to Hamburg. There is one preparation of this drug in the Pharmacopœia, an ointment, which is sometimes employed to relieve pain in rheumatism and neuralgia.

Sabathai, LEVI (1625-76), Jewish impostor, who pretended to be the Messiah, was born in Smyrna, and in youth acquired a knowledge of theology and of Arabic, which enabled him to pass for a learned and devout man. He had such powers of persuasion that few could resist him, and when, after an adventurous career in Syria, Italy, Greece, and elsewhere, he joined with an accomplice to personate the Messiah, great numbers fully believed in him. His accomplice, named Nathan, acted as a kind of precursor, and the Jews readily fell into the trap, multitudes renouncing their goods and following him, frantic with joy at the coming of the Messiah, as they deemed him. Finally, however, Sabathai was brought before Mahomet IV., Sultan of Turkey, who forced him by various expedients to confess his imposture, and he became a Mussulman to save his life.

Sabbath (from a Hebrew word signifying "rest from labour"), denotes the seventh day which, in the Mosaic Law, was set apart in commemoration of the finishing of the work of Creation. It was marked by a total cessation from labour, and had analogies with the seventh month and the seventh (Sabbatical) year. Nehemiah did much to revive its observation, and Rabbinical tradition increased its obligations to an oppressive degree, the Samaritans being more particular than the Jews in observing its minutiae. It was only gradually that Christians began to transfer some of the sabbatical obligations to their Sunday, and it was left for the Puritans to declare the Mosaic Law applicable to Christians in a still more strict sense than to the Jews. A stringent Act of Charles II. forbids Sunday trading and labour, works of charity and mercy being excepted. The Sabbatarians of the present day would forbid almost all recreation and amusement upon Sunday; but many Christian Churches and an increasing number of people in England, while considering that cessation from all but necessary toil is, if not of Divine ordination, yet very desirable, would encourage recreation and amusement.

Sabeans, a religious sect of Mesopotamia about the Lower Euphrates and in the neighbouring Persian valley of the Karûn river; are so named by the Arabs from one of their prophets, but call themselves *Mendayaha*—i.e. "Disciples of John." Their religion is a mixture of Jewish, Moslem, Christian, and even pagan rites, embodied in the *Sidra*, a sacred book supposed to be handed down through Seth and Enoch from Adam. It is written in the Chaldean language, a Semitic dialect related to Syriac, with a peculiar character of Phœnician origin, but with a complete vowel system attached to the consonants, as in Ethiopic. Formerly very numerous, especially in the Basra district, they were reduced in 1875 to about 8,000 in Mesopotamia, and a few scattered communities in Persia; headquarters Suk-esli-Shiok, in the territory of the Montefik Arabs, 224 miles from Baghdad. (*Comptes Rendus, Acad. des Inscriptions*, March, 1878.)

Sabellianism, a form of heresy in the early Christian Church, held by the followers of Sabellius,

who attempted a philosophical definition of the Trinity, and looked on the Son and Holy Ghost, not as distinct persons, but as manifestations of the Godhead. The heresy as such disappeared in the 5th century, but Sabellian views in substance are held by many people at the present day.

Sabine, GENERAL SIR EDWARD (1788-1883), scientist, was born in Dublin, and in early life saw some service in the army, which he entered in 1803, retiring in 1874 with the rank of general. His scientific researches led to his being appointed astronomer to one of the Arctic expeditions, but his greatest work was in the direction of terrestrial magnetism. He was employed several times by the Government to determine questions of longitude, and wrote largely on magnetism, some of his papers read before the Royal Society, of which he was President from 1861 to 1879, being very valuable.

Sabines, an ancient Italian people of the Central Apennines, belonged to the Indo-European race, and extended from Umbria to Lucania and Apulia. The Sabines, in a more particular sense, were those in the N., separated by the Tiber from Etruria, and from Rome by the Anio. They were a pastoral race, and, after being subdued by Rome in 290 B.C., received the Roman franchise. At an earlier period the Romans supplied themselves with wives by the well-known Sabine Rape. The Sabines had a curious custom of protecting themselves against over-population by declaring a Sacred Spring (*ver sacrum*), i.e. forcing all those born in a certain year to emigrate and found new colonies.

Sable (*Mustela zibellina*), a fur-bearing animal of the family Mustelidæ, widely distributed through the forest regions of Siberia. The sable is about two feet long, more stoutly built, and with a more



SABLE (*Mustela zibellina*).

bushy tail than the Pine Marten, of which it is probably a variety. The fur is lustrous brown, with a yellowish patch on the throat. It is of great commercial value, a skin of the first quality being worth more than £20. The North American Sable (*M. americana*) appears to be scarcely distinguishable. More than 100,000 skins have been imported into Britain by the Hudson Bay Company in a single year.

Sabot, a shoe carved out of a single piece of wood, and much employed by the country people in France, Germany, and Belgium, many parts of these countries being noted for their manufacture. Another form of sabot consists of a wooden iron-bound sole, with sides of strong leather. This

"clog" is in general use in the Lancashire manufacturing towns, where it was introduced from abroad. The name is also employed metaphorically in some trades.

Saccharic Acid possesses the composition $C_6H_{10}O_8$, being isomeric with three other allied acids—viz. mucic, iso- and manno-saccharic acids. It is obtained by the oxidation of sugar, usually by means of nitric acid. It forms a gummy, amorphous, soluble mass with a sour taste, which blackens and decomposes if heated. As ordinarily prepared, it acts on polarised light, being lævoro-rotatory, though dextro- and inactive compounds can also be prepared. [POLARISATION.] It forms well-defined crystalline salts, those of the alkalies being soluble in water.

Saccharimeters and **Saccharometers** are instruments used for determining the amount of sugar present in any solution such as beer, wort, etc. They may be of two forms. One measures the density of the solution, and to this the second name is usually applied; while the other measures the rotatory effect produced by the sugar upon polarised light. This is often known as a polarimeter, and is described under that title. The simplest form of saccharometer consists of a hydrometer (q.v.) with a graduated stem projecting above the liquid. The mark which stands at the level of the liquid is read off, and the corresponding amount of sugar present is found by referring to the table devised for the apparatus. This can only be used when no other substances affecting the density are present.

Saccharin. A number of derivatives obtained from sugars and other carbohydrates are known as saccharins, but the substance most commonly known under this name is an exceedingly sweet compound belonging to the aromatic series. This *saccharin* consists chemically of the imide of *sulpho-benzoic acid*, and has the composition represented by the formula $C_6H_4 \begin{smallmatrix} \text{CO} \\ \text{SO}_2 \end{smallmatrix} \text{NH}$. It

forms needle-like crystals, slightly soluble in cold water, more easily in hot. It has about 200 times the sweetening power of cane-sugar, and is more or less useful medicinally instead of sugar in the case of patients suffering from diabetes.

Saccharose. [SUGAR.]

Saccocirridæ. [ARCHI-CHÆTOPODA.]

Sacheverell, HENRY (1672?–1724), English divine, was born in Wiltshire, and, entering Magdalen College, Oxford, graduated D.D. in 1708, becoming a tutor there. He was made preacher at St. Saviour's, Southwark, and in 1709 delivered two sermons which had a remarkable effect, rousing great hostility to the Dissenters, to whom he attributed the approaching downfall of the Church. In 1710 he was impeached in the Commons and inhibited for three years. The two political parties fought over the question, and serious riots took place in London. Sacheverell was presented finally with a living near Shrewsbury, and made rector of St. Andrew's, Holborn.

Sachs, HANS (1494–1576), the best of the German *meister-singers*, was born at Nuremberg of humble family. He became a shoemaker, and remained one all his life. From one Nunnebeck, a weaver, he learned the art of rhyming, and joined the guild of singers in his native town. Sometimes he travelled a little, but it was in 1511 that he made a really extended tour through the principal towns of Germany. In 1519 he married, and, when his wife died in 1560, he married a second time. He was a staunch follower of Luther, and ardently desired the Reformation, for which he wrote numerous songs and hymns of great popularity. His writings are amazingly voluminous, there being over 6,200 poems by him, including over 200 tragedies, known to scholars. Only a portion of this vast material has been printed. It was Goethe who did much to rescue his memory from oblivion. The poetry of Sachs and the other artisan-poets is more remarkable for vigour than for beauty.

Sack (from *vino seco*), a name formerly applied to dry wines, especially those from Spain and the Canaries, and still later to all strong white wines. We read of "sherry-sack" and "canary-sack." These wines were generally sweetened and flavoured to taste, and sometimes warmed.

Sackville, GEORGE, VISCOUNT (1716–85), soldier and statesman, third son of the first Duke of Dorset, was educated at Westminster School and at Dublin University, whilst his father was Viceroy of Ireland. He entered the army in 1737, and fought bravely at Dettingen and Fontenoy, and in 1758 was made lieutenant-general. In the following year he was tried by court-martial on a charge of cowardice, and dismissed the service, the accusation being based on his refusal to lead his troops forward at the battle of Minden. After the accession of George III., however, he was reinstated in favour, and appointed Colonial Secretary during the American War (1775–82). He was created Viscount in the latter year. He was credited with the authorship of the *Junius Letters*.

Sacrament, a name signifying the Roman military oath, and used in the Vulgate as equivalent to the Greek *mysterion*, hence its adoption as the name of a symbolical religious ceremony. The Church defines a Sacrament as an "outward visible sign of an inward spiritual grace" imparted. The Greek and Roman Churches have seven Sacraments—Baptism, Confirmation, the Eucharist, Penance, Orders, Marriage, and Extreme Unction. Of these the English Church holds only the first and third to be sacraments in the full sense.

Sacramento. 1. The capital of California, stands on the left bank of the Sacramento river, 90 miles N.E. of San Francisco. The streets, which are broad, with trees on each side, are arranged on a rectangular plan. There are many handsome private dwellings with large gardens. The principal building is the State Capitol, a magnificent structure in a park of 50 acres. The works of the Southern Pacific Railroad are situated here, and there are flour- and planing-mills and other factories.

2. A river of California, rises near the Oregon

border, and flows S. between the Sierra Nevada and the Coast Range to Saisun Bay, a little above which it is joined by the San Joaquin from the S. It has a length of nearly 500 miles.

Sacrifice, the act of making an offering, or the thing offered, to a deity. Sacrifice of some kind finds a place in nearly all religions. Tylor supplies us with a clue to the origin of the rite. "As prayer is a request made to a deity as if he were a man, so sacrifice is a gift made to a deity as if he were a man" (*Prim. Cult.* ii. 375). What is generally called the "sacramental meal" theory of the origin of sacrifice does not appear to rest on solid ground, though in many cases the rite which began as a simple offering from a mortal to a deity developed into a sacramental meal, of which both mortal and deity partook. At first he who provided the offering was his own priest. Later there was developed a priestly caste standing between their fellows and the deity, and to them the duty of offering sacrifice was confined. Sacrifices were of two kinds—bloody, when the victim was killed, and unbloody, when the offering consisted of fruit, flowers, cakes, wines, etc. Tylor suggests that sacrifice has passed through three stages:—(1) It is offered as a simple gift; (2) it is offered as an act of homage or propitiation; (3) something valuable to, or greatly prized by, the sacrificer, is offered. As food was the most valuable thing known to primitive man, and as the gods of his making were like unto himself, his gifts to them probably took the form of food. In course of time, when the gods were conceived as without bodily wants, sacrifices were offered by fire, and the deities were supposed to be pleased with, and placated by, the smell of the burning flesh. Of Noah's burnt-offering we read that the "Lord smelled a sweet savour," and the statement may be paralleled in the classic poets (*cf. Il.* i. 317; *Ovid, Met.* xii. 154). It seems probable that at this stage the sacramental meal came in, for in the Jewish Scriptures we find minute details as to the parts to be eaten by the priests (who represented the people). The last stage found its highest expression in human sacrifice, in which the victim was sometimes self-dedicated, as when Marcus Curtius leaped into the gulf, and so gave to the gods "the most precious treasure of Rome." Many instances of, and references to, human sacrifice occur in the Jewish Scriptures; in one place at least with the direct idea of atonement—"Shall I give my first-born for my transgression, the fruit of my body for the sin of my soul?" (Micah vi. 7).

Sacrum, the bone formed by the union of the five sacral vertebræ and articulating on each side with the two hip-bones forming the posterior part of the pelvis (q.v.).

Sacy, ANTOINE ISAAC SYLVESTRE, BARON DE (1758-1838), Orientalist, was born in Paris, and was induced by a learned Benedictine, named Berthereau, to study the Eastern tongues. His proficiency was such that in 1785 he was made associate of the Academy of Inscriptions. On Napoleon's accession he became a member of the Institute,

and in 1808 professor of Persian at the College of France. After the return of the Bourbons he entered the Chamber of Deputies, and was created a peer by Louis Philippe and keeper of the royal collection of Oriental manuscripts. He was the father of modern Oriental studies, and produced some most valuable Arabic grammars, among other works.

Sadducees, a sect existing among the Jews in the time of Christ. The name has been variously derived from a word signifying "the righteous;" or from one Zadok, head of the Sanhedrim in the 3rd century B.C.; or from one Zadok the priest, who crowned Solomon, and whose descendants and adherents may have enjoyed especial privileges and adopted special tenets. From the New Testament we learn that they disputed the Pharisaic traditions, did not believe in a resurrection, and in some degree, as to which there is much dispute, did not believe in angels or spirits. Josephus, the only non-scriptural authority on them, was a Pharisee.

Sadi, or SAADI, SHEIKH MOSLIH EDDIN (1175-1301), a famous Persian poet, was a student of Bagdad, and was initiated into theological learning by a zealot of note, named Sophi abd al Kadir Ghilani, with whom he went to Mecca. This was the first of a series of fifteen pilgrimages to the holy place undertaken by Sadi, who several times aided the war against the infidels, and extended his wanderings into Asia Minor and India. He was taken prisoner by the Turks on one expedition, and was condemned to work as a slave at the fortifications of Tripoli. A rich merchant of Aleppo ransomed him, and gave him his daughter in marriage. Sadi spent the remainder of his life in a hermitage, which he had built near Shiraz, and was there buried. His tomb was visited as a holy place for generations. His poems are very beautiful, and have been often translated. Most remarkable of his works is *The Gulistan*, a collection of tales in prose interlarded with poems.

Sadoletto, JACOPO (1477-1547), Cardinal, was born at Modena, educated at Ferrara, and began to write Latin poetry at a youthful age. He became famous for his proficiency in verse, and was accounted one of the best Latin poets of his day. Leo X. made him one of his secretaries, afterwards giving him the see of Carpentras. Sadoletto was also a philosophical student and very learned. He was entrusted in 1538 with the task of endeavouring to win Calvin and his followers back to the fold after their banishment from Geneva, and he corresponded with Calvin on the subject. Paul III. created him a cardinal, and gave him some important missions.

Safe, a room or kind of box used for the safe keeping of valuables, may be either fixed or portable, the name being more generally applied to the latter, and having a wide range of application from the household meat-safe to the highly-elaborated bank-safe, which is constructed of the strongest and least perishable materials, and so contrived as to preserve its contents safe from fire, craft, or violence. Burglar-proof safes are marvels of

strength and ingenuity, as are also the various combination and time locks which make it almost impossible to obtain entrance without the proper key and a knowledge of its manipulation. The word is also used metaphorically in saddlery, plumbing, and distilling.

Safety-Lamp. It was discovered by Davy that flame will not under ordinary circumstances pass through fine-meshed wire gauze; the contact with the metal cools down the particles of gas to such an extent that they are incapable of inflaming the gas on the other side of the partition. It is essential that a safety-lamp to be used in mines liable to contain firedamp (light carburetted hydrogen) should be incapable of igniting an explosive atmosphere, and this end was attained by Davy by enclosing the flame of the lamp in a chimney made of, and closed at the top with, wire gauze. The oil-holder of such a lamp is made of brass, and care is taken to so secure the gauze to the body that no opening larger than the meshes exists. When such a lamp is taken into an inflammable atmosphere, the gas is ignited inside the lamp, which may thus be filled with flame, but an explosion is avoided. The presence of burning gas in the lamp thus serves to warn miners that the atmosphere has become dangerous. In recent years many attempts have been made to make electric safety-lamps, as then it is easy to so arrange matters that there is no chance of igniting explosive gas, and at the same time the light is much increased. Secondary or primary batteries have been used, but the weight and cost of the arrangement are greater than that of the Davy lamp, and, possibly from these causes, their use has up to the present time been limited.

Safety-Valve is used to indicate and relieve excessive pressure in steam-boilers or other vessels containing fluids under pressure. It usually consists of a conical plug fitting in a seating, and held in place by a lever and weight. As soon as the pressure exceeds a limit which is determined by the area of the valve, the length of the lever, and the mass of the weight, the plug is lifted, producing an escape of the steam or other fluid, and reducing the pressure. In some cases a spring is used instead of a weight, and in others a weight is placed directly upon the plug without the intervention of a lever.

Safflower, the flower-heads of *Carthamus tinctorius*, the "koosumbha" of India and "Hoang-tchi" of China, also known as "bastard saffron." Its native country is unknown, but it was formerly largely cultivated in Bengal, China, Egypt, and Southern Europe. It has an erect whitish stem over two feet high, spinous leaves, no pappus, and orange corollas. It yields two colouring matters, yellow and red, and is used for dyeing silk various shades of red, and as an adulterant of saffron. "Pink saucers" are coloured with safflower, and with steatite it constitutes *rouge*. Its seeds yield *koosum oil*, which is used in India in cooking and for burning, and in Europe for soap-making. The flower-heads are imported in small flat circular

cakes; but in place of an export from India of 500 tons, valued at £100,000, owing to the increased use of aniline dyes less than one-fifth of that amount, now only worth £4,500, is exported.

Saffron, the dried orange-coloured stigmas of *Crocus sativus*, a species unknown in a wild state, but cultivated in the neighbourhood of Saffron Walden, Essex, till 1768, in Cambridgeshire till the present century, and now in Spain and in the French department of Loiret. Not yielding a permanent dye, it is now little used as a dye, but is employed as a colouring-agent in pharmacy and to some extent in confectionery. The Cornish Saffron-cake is famous. One grain contains the stigmas of nine flowers—*i.e.* 4,320 go to the ounce. It has a bitter taste and an aromatic odour, and in large quantities is narcotic. It yields three-fourths of its weight of an orange-red extract, still extensively used on the Continent and in India. The annual import into the latter country is valued at £75,000. The best quality comes from Valencia, that from Alicante and Barcelona being loaded with heavy mineral matter. When formerly it was in higher repute for wholesomeness it took the place in stewing pears now occupied by cochineal. (*See* Shakespere's *Winter's Tale*, act iv. scene 1.) The so-called autumn crocus or meadow saffron is a *Colehieum* (q.v.), and has nothing to do with this plant or substance. The name "saffron" is of Arabic origin.

Ságar, the chief town of the Ságar district in the N.W. of the Central Provinces, India; lat. 23° 50' N., long. 78° 48' E. It is situated beside a fine lake of the same name, along the shores of which are bathing *gháts* and Hindu temples. It carries on a trade in salt.

Sagasta, PRAXEDO MATEO (b. 1827), Spanish statesman, born at Torrecilla, entered the Constituent Assembly or Cortes at Madrid in 1854. His strenuous opposition to Queen Isabella obliged him to leave Spain twice, but on her flight he became a minister. He is leader of the Liberal party, and formed a Government in November, 1885. Resigning in 1890, he became Premier again in December, 1892.

Sage (*Salvia officinalis*), a familiar pot-herb belonging to a genus of Labiatae (q.v.) which includes many species with showy flowers well known in our flower-gardens. The woolly leaves of the sage have an aromatic bitter taste, and are used in the preparation of force-meat or "stuffing" for pork or geese.

Saghalien, or SAKHALIN, a long, narrow island off the E. coast of Siberia between lat. 46° and 54° 30' N. and long. 141° 50' and 144° E. It is about 520 miles long from N. to S., the extreme breadth being about 90 miles; area, about 45,000 sq. m. It is separated from the mainland by the Gulf of Tartary, and from the island of Yesso in Japan by the Strait of La Perouse; on the N. is the Sea of Okhotsk. Mountain ranges of 5,000 feet, clad with forests, run from N. to S. The climate is very severe, cold mists occurring frequently even in

summer. Russia obtained Saghalien from Japan, in exchange for the northern Kurile Islands, in 1876. There is a settlement of about 5,000 convicts, who are engaged in working the coal-mines.

Saginaw, a well-built city of Michigan, United States of America, situated on a lofty tableland, 108 miles N.N.W. of Detroit by railway. It stands on the Saginaw river, which flows N. to Saginaw Bay, an inlet of Lake Huron.

Sagitta. [CHÆTOGNATHA.]

Sago, the granulated starch obtained from the pith of various species of palm, chiefly in the East Indian Archipelago, and shipped from Singapore. *Metroxylon* (*Sagus*) *Rumphii* and *M. leve*, the chief sago-yielding species, are especially cultivated in the island of Ceram, in Borneo, and in Sarawak. Inferior kinds are derived from the Gomuti palm (*Arenga saccharifera*), the Kittool Palm (*Caryota urens*), the Cabbage Palm (*Corypha umbraculifera*), from *C. Gebanga*, and other species. They grow in low marshy situations, becoming mature in about fifteen years, when they are felled and split and the abundant starch washed out of the central spongy tissue and passed through sieves. Were the fruit allowed to form and ripen, all this tissue would be absorbed, the stem becoming hollow and the tree dying directly after fruiting. Sago is imported in three finenesses—common brown or large sago, pearl sago, and sago flour, in small boxes or bags of $\frac{1}{4}$ to 2 cwts. each. Our imports have been approximately 9,000 tons in 1860, 13,500 tons in 1870, 19,000 tons in 1880, and 28,000 tons in 1890.

Saguntum, an ancient city of Spain, in Hispania Tarraconensis, near the mouth of the Pallantias, where now stands the town of Murviedro. It was a busy mart in classical times, but owes its fame to the persistency and courage shown by the inhabitants when besieged by Hannibal in 219 B.C. After a siege of nearly a year, when further resistance had become useless, the men marched forth for a final sally, whilst the women threw themselves with their children on a pyre composed of all their worldly goods. This event was the immediate cause of the Second Punic War.

Sahara, the great North African desert, lies between the Barbary States (Morocco, Algeria, Tunis, Tripoli) on the N., the Atlantic on the W., and the Nile Valley on the E. Its limits are approximately lat. 16° and 33° N., and long. 17° W. and 33° E., and its area is estimated at 2,500,000 square miles. The N.E. portion, the Libyan Desert, slopes N. towards the Atlantic. It was formerly supposed that the Sahara was the bed of an ancient sea, that it lay below the sea-level, and that it was composed entirely of tracts of sand, the position of which was constantly changing. Recent explorations, however, have shown that the surface is extremely varied and in most parts more or less elevated, rising at one spot to a height of at least 8,000 feet. On the N. it is enclosed by a semi-circular range of parallel sand-dunes, extending

from Fezzan to the vicinity of Cape Blanco. The central region, S. of Algeria, consists of a tableland of 4,000 feet, called Ahaggar, with mountains of 6,500 feet, on which the snow lies for three months in the year. Still more lofty are the eastern ranges, the altitude of Mount Tusidde, in the Tibboo region, being 8,000 feet above the sea. The mountains in the W. do not exceed 2,000 feet in height. Along the valleys which abound in the mountainous regions lie the beds of ancient rivers, from which water may be obtained at no great distance from the surface. They thus afford pasturage for cattle, sheep, and camels, and are nearly always inhabited. The parts of the Sahara called "hammada" have a level surface covered with masses of granite and other rocks without vegetation of any kind; elsewhere there are wide salt marshes from which the water has evaporated, and large tracts are composed entirely of sand or of small round stones. The oases (q.v.) often extend in a continuous line right across the desert, as, for example, that from Morocco to Cairo through Tafilet, Tuat, and Ghadames. There is a similar line from Mourzouk, in Fezzan, to Lake Tchad and several others which furnish a means of communication between the Soudanese states and the shores of the Mediterranean. The caravan-trade carried on along these routes consists chiefly in the exchange of ivory, gold-dust, ostrich-feathers, gums, spices, and salt for manufactured articles, jewellery, etc. Several schemes have been put forward by the French for constructing a railway from the Mediterranean to the fertile regions of the interior. Their purpose is probably political as well as commercial, for they aim at gaining possession of the vast region between Algeria and Tunis and their colonies on the Senegal and the Niger. The agreement between Great Britain and France drawn up in 1890 leaves them at liberty to take possession of these lands so far as this country is concerned. After rising much above 100° F. in the day time, the thermometer often falls to freezing-point, or lower, during the night. In most parts of the Sahara rain falls only at intervals of two, three, four, or even five years. Outside the oases the vegetation consists chiefly of coarse grasses, tamarisks, and thorny trees or shrubs, such as the prickly acacia. The antelope, giraffe, and jackals are among the commonest quadrupeds. The salt and dates obtained in the Sahara form important articles of food. The inhabitants are Berbers—viz. Moors towards the coast and Touaricks (Tuaregs) farther inland, Tibboos, a mixed race of Berbers and Negroes, in the region S. of Tripoli and E. of the Touaricks, pure Negroes, Arabs, and Jews. The trade is mainly in the hands of the Touaricks.

Saháranpur, a town of the North-West Provinces, India, in lat. $29^{\circ} 58'$ N., long. $77^{\circ} 35'$ E. It is situated in a low and damp country, and was formerly very unhealthy, but a malarious lake in the neighbourhood has now been drained. A handsome new mosque has recently been built by the Mohammedans, who form the majority of the population. The Government botanic gardens (1817) cover about 50 acres. This place is a station of the Great Trigonometrical Survey.

Saiga (*Saiga tartarica*), an antelope from the Steppes of Eastern Europe and Western Asia. It is about the size of a fallow deer, tawny yellow in summer, and light-grey in winter. The nose is very large, convex, and inflated, so that the animals have to walk backwards as they graze.

Saigon, the capital of French Cochin China, situated on the Saigon river (one of the branches of the Mekhong delta) in lat. $10^{\circ} 47' N.$, long. $106^{\circ} 45' E.$ Since 1861 a handsome town of European aspect has sprung up, with a cathedral, a palace for the governor, an arsenal, docks, etc. The trade is mainly carried on by the Chinese, who mostly reside in the suburb of Cholon. The exports include rice, fish, and wood. Nearly 500 vessels enter the port annually.

Sail (derived from Latin *sagulum*, "a cloak"), a device used on board a boat or ship for catching the wind and so propelling the vessel. It generally consists of several breadths of canvas, served with a double seam at the corners, and edged by cords called bolt-ropes. Sails used on square-rigged vessels and fixed on yards are called square-sails; those fixed on a gaff, boom, or stay, are called fore-and-aft sails. The top of a square sail is the *head*, the bottom the *foot*, the weather- or windward-side is called the *luff*, the other side the *after-leech*. The two lower corners are called *clues*, the weather clue being the *tack*. The sails take their prefix from the masts, and consist of *courses*, *topsails*, and *top-gallant-sails*. Other varieties are lug-sails, which are extended on a yard hauled nearly to the top of a mast, spritsails, the outer upper corner of which is extended by a sprit or boom going from the bottom of the mast, and lateen sails, which are much used in the East and have a long yard or boom affixed to a short mast. Many other sails are also in use, and on some yachts silk is employed as a material. Sails are also used on windmills to catch the wind.

Sainfoin, or SAINTFOIN, *i.e.* "holy hay" (*Onobrychis sativa*), is a handsome leguminous plant, with pinnate leaves, dense pyramidal racemes of pink papilionaceous flowers, marked with lines of a deeper shade, and wrinkled one-seeded pods. It is doubtfully native on the chalk downs of south-east England, and, though native to Central Europe, is often an escape from cultivation. It is much grown as fodder for milch-cows and for sheep during winter.

Saint, a word much employed, especially in the Christian religion, to denote a holy man or being, or sometimes thing. In its strictest sense in theology it is applied to angels, apostles, and holy men and women, and generally only to such as have been canonised by due authority. Thus most of the Saxon saints were without canonisation. It is also used to denote the pure and upright, and has been arrogated by certain sects as a name to distinguish them. It is also used to denote the blessed dead, and all members living and dead of the Christian Church. Thus the Church of England speaks of the "communion of saints," and prays, "Make us to be numbered with Thy saints." The Mohammedans have great reverence for their saints.

St. Albans, a city and municipal borough of Hertfordshire, on Watling Street and the river Ver, 21 miles N.N.W. of London. It is situated on the slope of a hill near the site of the Roman station, Verulamium, which was originally a British town. A Benedictine monastery was founded here by Offa, King of Mercia, in 793 to commemorate St. Alban, a Roman soldier who suffered martyrdom some 500 years earlier. The abbey-church was rebuilt in the latter part of the 11th century, and preserves its Norman character in spite of various new features in each of the Gothic styles. It is exceptionally long, the distance from E. to W. being 548 feet. Since 1871 the church has been restored, mainly by Lord Grimthorpe, and in 1877 it was made the cathedral of a new diocese. The shrine of the saint, reduced to fragments in the 16th century, has been reconstructed by Sir Gilbert Scott, and there is a fine monument of Humphrey, Duke of Gloucester. The grammar school, founded 1553, is now located in the abbey gatehouse.

St. Aloysius (LUIGI GONZAGA, Marquis of Castiglione, 1568–1591) renounced his Marquisate and became a Jesuit in 1585. He devoted himself to the care of those sick of the plague in Rome, and died of the disease. He was canonised in 1726.

St. Andrews, a Scotch parliamentary and royal burgh, situated on St. Andrews Bay on the E. coast of Fife, 42 miles N.N.E. of Edinburgh. The ecclesiastical history of the town can be traced back to the 6th century, when a monastery (Kilrimont) was founded here by St. Kenneth. In the early part of the 10th century it was already the seat of the Scotch primate. The cathedral and Castle (bishop's palace), begun about 1160 and 1200 respectively, are both in ruins. There are some scanty remains of the Augustinian and Dominican monasteries, founded 1144 and 1274, but that of the Greyfriars has wholly disappeared. The interesting Romanesque church of St. Regulus or St. Rule has a lofty square tower, which is believed by some antiquaries to be of Culdee origin. The university, founded 1411, is the oldest in Scotland. It comprises the United Colleges of St. Salvator and St. Leonard, with courses in arts and medicine, and the theological college of St. Mary. St. Salvator's College was originally founded in 1455, St. Leonard's in 1512, and St. Mary's in 1537. The chief school is the Madras College, founded by Dr. Bell in 1833. St. Andrews was a place of commercial importance in the 15th and 16th centuries, but its trade is now small, and of late years the fishing industry has declined. Since about 1855 or 1860 it has come into much favour as a watering-place, and a new town has rapidly sprung up. The St. Andrews golf-links are noted, and clubs and balls are manufactured.

St.-Arnaud, JACQUES ACHILLE LEROY DE (1801–54), Marshal of France, was born in Paris, and first entered the army in 1816, but after a short period he went upon the stage and remained an actor for ten years, re-entering the army in 1831. He aided in the suppression of the La Vendée insurrection, and spent fifteen years in Algeria,

greatly distinguishing himself. He became general in 1847, subdued the Kabyles, and was made Minister of War in 1851, in which year he took a leading part in carrying out the *coup d'état*. He held the chief French command in the early days of the Crimean war, but died shortly after the Alma.

St. Asaph, a cathedral city of Wales, on the borders of Flintshire and Denbighshire, five miles N. of Denbigh. It is situated on an eminence in the Vale of Clwyd, near the junction of that river with the Elwy. St. Asaph was a disciple of St. Kentigern (d. 603), who is said to have been the actual founder of the see. The cathedral, which is the smallest in Great Britain, is mainly Decorated, with a central tower of 93 feet.

St. Bees, a small town on the coast of Cumberland, four miles S. of Whitehaven. The Culdee

their way. The breed is said to have sprung from a mastiff and a Danish bull-bitch, though the date is uncertain. This breed, however, was kept pure at the hospice for a long period; now they seem to be dying out. It was stated in March, 1894, that there were only five at the hospice in the early part of that year. About 1860 St. Bernards were introduced into England, and soon became very popular. The general coloration is orange, red, or fawn, with a good deal of white. There are two varieties, one with a rough, the other with a smooth coat.

St. Christopher, or ST. KITTS, a West Indian island, belonging to the Windward or North Caribbean group, which has been held by England, though not continuously, since 1713. It is 45 miles N.W. of Guadaloupe, and has an area of 68 square miles. It is traversed by a mountain-range, which attains a height of 4,100 feet. The chief products are sugar, molasses, rum, and salt. Basseterre (q.v.) is the capital.

St. Cloud, a French town, in the department of Seine-et-Oise, four miles W. of Paris. The château built by the Duke of Orleans, brother of Louis XIV., afterwards became a royal palace, and was occupied by Napoleon. It was destroyed during the second siege of Paris (1870).

St. Davids, a small town in the W. of Pembrokeshire, 6 miles W.N.W. of Haverfordwest. It is situated near the N. coast of St. Bride's Bay, 1½ miles inland. The cathedral, a cruciform Transitional structure, was begun in 1176. The most noteworthy features are the richly-ornamented nave, which has a fretted timber roof, the beautiful 14th-century stone rood-screen, the carved choir stalls, the tomb of Edmund, Earl of Richmond, father

of Henry VII., and the shrine of St. David. The ruins of St. Mary's College (1377) are picturesque, and Bishop Gower's palace (1342) is a remarkably fine example of mediæval domestic architecture.

St. Denis, a French town in the department of Seine, five miles N. of Paris. The abbey, built by Dagobert in the 7th century on the site of an old chapel which marked the resting-place of St. Denis, became the place of burial for the French sovereigns. The existing structure, begun by the Abbé Suger, was restored by Viollet-le-Duc in 1848 and the following years.

Ste.-Beuve, CHARLES AUGUSTIN DE (1804-69), an eminent French critic, was born at Boulogne-sur-Mer. On his mother's side he was of English descent, and this accounts for his early attraction to English literature. At the age of fourteen he was sent to the Collège Charlemagne at Paris to finish his education, and, after studying medicine, he followed the profession of a doctor for a time;



THE GREAT ST. BERNARD HOSPICE.

nunnery, founded by St. Begha in the 7th century, having been destroyed by the Danes, a Benedictine priory was established here in the time of Henry I. St Bees' Theological College was founded by Bishop Law in 1816 for the benefit of those who cannot study at Oxford or Cambridge.

St. Bernard. 1. The name of two Alpine passes. The Great St. Bernard (8,131 feet), now crossed by a road, is in the Pennine Alps, E. of Mont Blanc, between Piedmont and the Swiss canton of Valais. Near its summit is the hospice established by Bernard de Menthon (962) for the use of pilgrims to Rome. It is in the charge of Augustinian monks, who rescue travellers with the aid of dogs. The Little St. Bernard is in the Graian Alps, S. of Mont Blanc, between Piedmont and Savoy.

2. A breed of large dogs deriving their name from the Augustinian hospice in the Great St. Bernard Pass, where they were employed as guides by the monks in their journeys to the foot of the pass on each side to assist travellers on

but a love for literature and some chance contributions of his to the papers decided him in giving it up. He joined the romantic movement after reading Hugo's poems, which impressed him greatly. In 1828 appeared his first work, a *Tableau Historique et Critique de la Poésie Française et du Théâtre Français au XVI. Siècle*, an excellent work, somewhat enlarged by him in later years. He published a volume of poems in 1829 over the pseudonym of "Joseph Delorme," but the second collection of poems, *Les Consolations* (1830), were much better. About this time he began to write for the leading periodicals, and began his admirable *Portraits Littéraires*, which were followed much later by his still more remarkable *Causeries du Lundi*, which came out every Monday in *Le Constitutionnel* newspaper, and proved him one of the finest of critics. To full knowledge of his subjects were added an inimitable style and exquisite critical discernment. In 1840 he obtained from M. Thiers the post of keeper of the Mazarin Library, and in 1845 he entered the Academy, succeeding Casimir Delavigne. He supported the Government after the *coup d'état* of 1851, and received the appointment of professor of Latin poetry at the Collège de France, but the students, resenting his conversion to monarchism, refused to hear him, and he was obliged to accept a similar position at the École Normale. Napoleon III. made him a senator in 1865. His works are not numerous in one sense, though they fill many volumes. The *Causeries* occupy about twenty of them, and other works of his deserving of mention are *Histoire de Port Royal* (1840-62), *Portraits de Femmes* (1844), and *Portraits Contemporains* (1846). His *Poésies Complètes* appeared in 1840. He wrote numberless prefaces and introductory essays.

Ste.-Claire Deville, HENRI ÉTIENNE (1818-81), chemist, was born in the Antilles of French parents, and was educated in France. From an early period he devoted himself to patient chemical researches, and, after taking his degrees of doctor of medicine and of science, became professor of chemistry at Besançon in 1845. He was appointed examiner at the École Normale of Paris in 1851, and in 1853 published a new system of mineral analysis. He was especially notable in mineral chemistry. He discovered the properties of composite nitric acid, and simplified the extraction of aluminium. He obtained the Legion of Honour in 1855.

St. Elmo's Fire is the name given by sailors to a faint flame or glow sometimes seen at the tips of masts and spars in thundery weather. It is due to the dissipation of atmospheric electricity in the form of a brush discharge (q.v.).

St. Étienne, an important but smoky and unattractive town of France, in the department of Loire, on the Furens, an affluent of the Loire, 36 miles S.W. of Lyons by railway. The manufacture of ribbons (mostly hand-made) and other silk articles gives employment to about 40,000 workers. More than 20,000 hands are engaged in the manufacture of steel and iron plates, firearms, cutlery, and other metal wares. The number of persons at work on the neighbouring coal-beds is estimated at 17,000.

St.-Evremond, CHARLES MARQUETEL DE ST. DENIS (1613-1703), SEIGNEUR DE, a noble author and wit, was born in France, and entered the army, serving gallantly at the siege of Arras and becoming a general under the Prince de Condé. He was as witty as he was brave, and a few shafts of satire directed against the Prince caused his disgrace. He lost his commission and was kept in the Bastille for three months, fleeing to England to escape a second detention. He accompanied the Duchess of Mazarin, and was one of the chief ornaments of Charles II.'s court. He died in London and was buried in Westminster Abbey. His writings are clever essays and letters, and were first published in an imperfect form in 1668. The first authentic edition appeared in three volumes in London in 1705.

St. Gall, a canton of N.E. Switzerland, to the S. of the Lake of Constance; area, 780 square miles. It completely encircles the canton of Appenzell, and is separated by the Rhine on the E. from the Tyrol. The surface is hilly, in parts even mountainous. The embroidery of cottons and muslins forms the chief industry. The inhabitants speak German, and the Canton is mainly Roman Catholic, while the town is almost entirely Protestant. The capital, ST. GALL, is situated on the Steinach, at an altitude of 2,200 feet, about 7 miles S.W. of the Lake of Constance. It grew up between the 8th and the 10th centuries round the Benedictine monastery which marked the site of the hermitage of St. Gall, a disciple of St. Columban who established himself here in 614. During the Middle Ages the monks became famous for their learning, their love of music, and, above all, their zeal in collecting MSS. It is to their care alone that we are indebted for our knowledge of Quintilian and other classical authors. The monastic library is still preserved in the ancient buildings, which have been converted into government offices and schools. The abbey church was restored in the last century, and there is a town library dating from 1536. The present canton was formed in 1803. St. Gall became the seat of a bishop in 1836.

St. George, St. Patrick, St. Paul, etc.
[See THE VARIOUS NAMES.]

St. Germain-en-Laye, a French town in the department of Seine-et-Oise, 10 miles W.N.W. of Paris. The royal castle, rebuilt by Francis I., was the chief residence of the French kings prior to the reign of Louis XIV., when the court was established at Versailles. James II. resided here after his flight from England. After being used as a barracks and a military prison, the palace was converted by Napoleon III. into a museum for Celtic antiquities. The forest of St. Germain covers about 10,000 acres.

St. Gothard, an Alpine group between the Swiss cantons of Uri and Ticino which reaches the height of 9,850 feet. The St. Gothard pass (6,936 feet) has a hospice for travellers 69 feet below the summit. The road over the pass was improved in 1820-24. The St. Gothard is now pierced by a railway tunnel (constructed 1872-80), which extends from Göschenen to Airolo, a distance of over 9 miles.

St. Helena, an island of the S. Atlantic, in lat. $15^{\circ} 56'$ S., long. $5^{\circ} 43'$ W., 1,200 miles from the West Coast of Africa. It is $10\frac{1}{2}$ miles long from E. to W. and 7 miles broad, and has an area of 47 square miles. The dark-grey igneous cliffs rise precipitously to a lofty table-land, the highest point on which is 2,823 feet above the sea. Jamestown, the capital, is situated in a ravine sloping down to the N.W. coast. The climate is healthy, the mean temperature being 62° . Whale-fishing is the only considerable industry. The affairs of the island are administered by a governor and an executive council. Since the construction of the Suez Canal it has ceased to be a port of call for eastward-bound vessels, and its prosperity has greatly declined. Longwood, the residence of Napoleon from 1815 to 1821, is situated in the northern part of the island, on a level tract richly clad with verdure.

St. Helens, an important commercial town in Lancashire, 12 miles E.N.E. of Liverpool. Within a recent period it was still a small village. It is the centre of the plate-glass industry, and also contains alkali, iron, and copper-smelting works.

St. Helier, the capital of Jersey, is situated on St. Aubin's Bay on the S. side of the island. It is protected by Fort Regent (1806-15), which stands on a height on the E. side of the harbour, and by Elizabeth Castle (1551-86), built on a rock which is connected with the shore by a causeway. Victoria College (1852) is a school of some standing. The town has a good harbour and carries on a considerable trade. It is also a favourite watering-place. A zoological station was opened in 1893.

St. Ives. 1. A quaint old town on the N. coast of Cornwall, 8 miles N.N.E. of Penzance. The pier was built by Smeaton in 1770. Most of the inhabitants are engaged in the pilchard-fisheries.

2. An ancient town of Huntingdonshire, on the Ouse, 5 miles E. of Huntingdon. The church of St. James is an interesting Norman and Early English edifice. The Ouse is here crossed by a beautiful bridge, built by the abbots of Ramsey. Oliver Cromwell resided at Slepe Hall.

St. John, the most important town in New Brunswick, situated at the mouth of the St. John river, 53 miles S.E. of Fredericton. The harbour is safe and commodious. St. John has a large timber trade, and shipbuilding is an important industry. The manufactures include steam-engines, iron-castings, and machinery of various kinds, agricultural implements, boots and shoes, etc. A new and handsome town has quickly grown up on the site of that burnt down in 1877.

St. John's-wort, the popular name for most members of the genus *Hypericum*, the type of the thalamifloral order Hypericaceæ. They may be shrubby or herbaceous, and have opposite and decussate simple leaves, often dotted with glands; yellow, pentamerous, polysymmetric flowers, with triadelphous or polyadelphous stamens originating in branching; and a capsular fruit with distinct styles (generally tricarpeal). Once considered

a remedy for epilepsy, St. John's-wort came to be looked upon as a charm against evil spirits, and to be used in rustic divination. It is named from the fact that it flowers about the time of the feast of the nativity of St. John the Baptist (June 24th).

St.-Just, LOUIS ANTOINE (1768-94), revolutionist, was born in Nivernais, and studied law for a while, eventually turning his attention to literature, and writing various poems from which decency is always absent. During the Revolution he rose rapidly to prominence, and became one of Robespierre's most sanguinary associates. Indeed, it is now believed that Robespierre's cruelty was largely the result of St. Just's bloodthirsty inclinations. He was a fanatic and hesitated at nothing. He strongly advocated the execution of Louis XVI., and voted for the destruction of the Girondists. In Alsace, to which he had been sent as commissioner, his ferocity was equally marked. He was condemned to the guillotine at the same time as Robespierre.

St. Lawrence, a great river of North America which flows about 750 miles N.E. from Lake Ontario to the Gulf of St. Lawrence. In a wider sense the name embraces the whole chain of great lakes (Superior, Michigan, Huron, Erie, Ontario), with the rivers between them up to the river St. Louis in Minnesota, the ultimate source of this enormous mass of fresh water, which has a drainage basin of 297,600 square miles. For nearly half its course the St. Lawrence varies in width from 1 mile or under to 3 or 4 miles, but about 400 miles above the Gulf it begins to expand into a broad estuary, the distance between the banks at the mouth being over 100 miles. Some of the broader parts of the upper river are studded with numerous islands, and a long stretch immediately below Lake Ontario, called the "Lake of the Thousand Isles," is famous for its beautiful scenery. The channel was widened and deepened in 1858, so as to afford access for vessels of 4,000 tons to Montreal, 600 miles above the mouth. The chief tributaries are the Ottawa and the Richelieu. The GULF OF ST. LAWRENCE, into which the river flows, lies between Labrador on the N., Lower Canada on the W., New Brunswick on the S.W., Nova Scotia and Cape Breton Island on the S., and Newfoundland on the E. Its length from N. to S. is about 300 miles, and its breadth about 240 miles.

St. Louis, a city in the State of Missouri, U.S.A., situated on the Mississippi, 21 miles below its confluence with the Missouri. It ranks fifth in point of population, and forms an important commercial centre. The city is built on three terraces, beyond the highest of which extends a broad plain. 4 miles from the river and 200 feet above its level. Its river frontage is $18\frac{1}{2}$ miles, 3 miles of which are occupied by wharves. The newer part of the town consists of broad, straight streets, but the public buildings, though massive and solid, are not remarkable for the beauty of their architecture; the law courts, the county court-house, the custom-house, and the post-office are the most important. The city contains two

universities (the Washington and the St. Louis), besides numerous schools of high repute. The Eads steel bridge is built on three arches, of which that in the centre has a span of 520 feet and each of the others a span of 504 feet. The history of the city dates back to 1764, when the French Louisiana Fur Company established a station here, but it had made little progress in 1803, when it was acquired by the United States. Since 1840 its growth has been rapid, and its trade continues to increase from year to year. It is the centre of an agricultural district from which it receives large supplies of grain; cotton is also imported extensively, and beer, corn and tobacco rank among its chief products. The principal manufacture is that of boots and shoes. St. Louis is the centre of 18 lines of railroad.

St. Malo, a fortified seaport in Brittany, at the mouth of the Rance, in the department of Ille-et-Vilaine, 42 miles N. by W. of Rennes. It is built in the form of an amphitheatre on a rocky island connected by a causeway with the mainland. The harbour, which is safe but difficult of access, is dry at low water, but at spring tides it has a depth of 45 or 50 feet. St. Malo carries on a large trade, mainly with Great Britain, the chief exports being butter, eggs, potatoes, buckwheat, barley, and fruit.

St. Michael's Mount, a pyramidal rock of granite in Mounts Bay, Cornwall, 3 miles E. of Penzance. It is connected with Marazion on the mainland by a causeway which is covered by the tide during 8 hours out of the 12. The castle on its summit (195 feet above the sands), which has belonged to the St. Aubyn family since 1660, occupies the site of a Benedictine priory founded by Edward the Confessor. The ancient portion comprises a hall, a refectory, a Perpendicular chapel, and a tower, also Perpendicular, with a stone lantern at the S.W. angle.

St. Michel, MONT, an insulated granite rock of conical form off the department of La Manche in Normandy, 18 miles W.S.W. of Avranches. Its steep ascent from the surrounding sands to a height of 242 feet, where it terminates in a platform on which there are buildings, gives it a very picturesque appearance. A temple or fortress attributed to Druids existed here at a very early date, and in the 8th century a Benedictine monastery was erected on the spot where St. Michael had appeared in a vision. The castellated buildings of the abbey range in date from the 12th to the 16th century. At the foot of the mount there is a town of about 400 inhabitants. For considerable periods the buildings have been a State prison, and Cardinal Ballue and Armand Barbès (q.v.) were among those confined here.

St. Nazaire, a French port on the N. side of the estuary of the Loire, 35 miles W. by N. of Nantes. Docks, extending over 80 acres, were constructed between 1845 and 1881, and the town is now an important commercial centre. The exports include brandy, wine, coal, poultry, and eggs.

St. Paul, the capital of Minnesota State, United States of America, is situated on the Mississippi

river, a short distance below the point where it is joined by the Minnesota. The population increased from 500 in 1849 to 150,000 in 1891. The larger part of the city stands on a plateau 70 feet above the river, in the midst of an amphitheatre of hills. St. Paul is noted for its excellent schools. It is the head of the steamboat navigation of the river, and manufactures machinery, farming implements, carriages, and boots and shoes.

St. Paul's School was founded (1509-12) by Dean John Colet for 153 boys without restriction as to class or nationality. It was originally in St. Paul's Churchyard, and was burnt in 1666. Two later schools were built, and in 1884 it was removed, under a scheme of the Charity Commissioners, to West Kensington, and has accommodation for 500 boys, with a modern school for 500 boys and a school for 400 girls. Its governors are appointed partly by the Universities. There are exhibitions to Oxford, Cambridge, and Woolwich. Lilye was the first headmaster, and among noted Paulines were Samuel Pepys, the Duke of Marlborough, Judge Jeffreys, and Nelson.

St.-Pierre, JACQUES BERNARDIN DE (1737-1814), romantic writer, was born at Havre, and was apprenticed to an engineer, after which he served for a time in an engineering corps in the army, and was sent to Russia for some time. His literary tastes, however, led to his abandonment of his profession, and he settled down to authorship, producing various admirable works, such as *La Chaumière Indienne*, *Etudes de la Nature* (1784), *Harmonies de la Nature*, and especially the beautiful story of *Paul et Virginie* (1788), which went through fifty editions in a year, and is known and appreciated throughout the civilised world. So touching and graceful an idyll came as an oasis in the materialistic desert of French literature of the period. St. Pierre was an enthusiastic disciple of Rousseau, and his intense love of nature was largely due to his study of Jean Jacques' writings. Napoleon conferred upon him the Legion of Honour, and he was given a pension of 6,000 francs by Joseph Bonaparte.

St. Quentin, a French town on the Somme in the department of Aisne, 33 miles S. of Cambrai. The church is a noble building, ranging in date from the 12th to the 15th century, with a crypt of much greater age. The handsome Gothic town-hall was erected in the 15th and 16th centuries. Cotton goods and embroidery are manufactured on a large scale. A French army under the Constable de Montmorency was defeated here in August, 1557, by the joint forces of the English and Spaniards, and in 1871 the Germans defeated the French under Faidherbe.

St.-Real, CÆSAR VACHARD, ABBÉ DE (1639-92), Savoyard historian, was educated by the Jesuits at Paris, to which he was sent at the age of sixteen. He gave much attention to historical study, and was made historiographer of Savoy after his return from England, whither he had accompanied St. Evremond and the Duchess of Mazarin. He wrote the memoirs of the last-named, but his

principal work is his *Conjuration de Venise* (1674), a masterpiece in its way, and modelled on Sallust.

St.-Saens, CHARLES CAMILLE (b. 1835), composer, born at Paris, entered the Conservatoire in 1847, and obtained several prizes. At the age of seventeen he composed his first symphony, and in 1853 received his first appointment as organist. Five years later he became organist at the Madeleine. He gained the prize offered in 1867 by the International Exhibition for his cantata *Les Noces de Prométhée*. In 1877 his sacred drama *Samson et Delilah* was produced at Weimar. He is one of the greatest of contemporary composers, and has made several visits to England to conduct his own works.

St.-Simon, CLAUDE HENRI, COUNT DE (1760-1825), socialist and humanitarian, was born at Paris, and studied under D'Alembert, afterwards serving in the army for twelve years. His sympathetic nature led to his founding the party or sect called after his name, his desire being to ameliorate the suffering of the masses. In pursuance of this object he spent his fortune, and, disbelieving in hereditary rank, renounced his title. One of his chief propositions was that industry alone was the cause of happiness, and that rank should depend upon the fitness of the individual to live up to the ideal of labour. He made himself a beggar by his scheme, and was at times literally starving, being glad at last to obtain a clerkship at £40 a year. In 1823 he attempted suicide. He had comparatively few disciples, though many of them were, or became, men of high distinction. The sect broke up chiefly through disputes as to the position of women. His system was an essentially religious and despotic type of Socialism. In 1807 he formulated it in the *Introduction to the Scientific Achievements of the 19th Century*, and his later works, such as *Catéchisme des Industriels*, *Nouveau Christianisme*, *L'Industrie, ou Discussions politiques, morales et philosophiques*, are full of his ardent philanthropy. He was the inspirer of Auguste Comte (q.v.).

St.-Simon, LOUIS DE ROUVEROI, DUKE OF (1675-1755), was a notable diplomatist in the reign of Louis XIV. He had been a soldier, and had fought in Flanders, but diplomacy was a natural outcome of his keen, observant mind. He lived in what has been called the Augustan age of French literature, and his remarkable memoirs are probably the most valuable record of the time in existence. There all his famous contemporaries appear, and many hidden springs of royal action are revealed. Saint-Simon was a courtier, and was entrusted in 1721 with the task, as ambassador to Spain, of arranging a marriage between the Infanta and Louis XV. He was also a member of the council of the Duke of Orleans. The first complete edition of his memoirs appeared in 1830, but there is a later edition in 20 volumes.

St.-Victor, ADAM OF, a Latin hymnologist of the 12th century, who lived in the abbey of St. Victor in Paris, and was a personal friend of Thomas Becket. His complete hymns were published in 1858, and are considered excellent specimens of

mediæval Latin poetry. HUGH OF ST. VICTOR, who died in 1141, was called the Second Augustine, and was a famous twelfth-century mystic. He taught theology at the abbey already referred to, and one of his pupils was RICHARD OF ST. VICTOR, a Scot, who became prior in 1162 and died in 1173, and whose works were collected and published for the first time in 1506.

St. Vincent, a West Indian island belonging to the Windward Group, 105 miles W. of Barbadoes; area, 132 square miles. The interior is mountainous, and in the N.W. there is an active volcano, the Soufrière (3,000 feet), with a crater three miles in circumference. The capital, Kingstown, is on the S.W. coast. Sugar, rum, cocoa, cotton, and arrow-root are the chief products. St. Vincent has been an English possession since 1783.

St. Vincent, CAPE, the S.W. extremity of Portugal, has been the scene of several naval battles, the most famous being that which took place on February 14, 1797. In this engagement Admiral John Jervis, afterwards Earl St. Vincent, at the head of 15 sail of the line and 7 frigates, defeated a Spanish fleet containing 27 ships.

St.-Vincent, JOHN JERVIS, EARL OF (1734-1823), joined the navy at the age of ten and rapidly advanced in the service. He was present in the expedition against Quebec, in the action off Ushant under Keppel in 1778, and in 1794 commanded the squadron in the West Indies, which took Guadaloupe, Martinique, and St. Lucia. His greatest achievement was the decisive victory gained over the Spanish fleet off Cape St. Vincent in February, 1797, for which he was raised to the peerage and given a pension of £3,000. The House of Commons voted him a statue in St. Paul's.

Saintsbury, GEORGE EDWARD (b. 1845), critic, was born at Southampton and educated at King's College, London, and Oxford, where he graduated in 1868. For some years he held appointments as a master at various schools. He is known as the author of a *Life of Dryden* (1881), a *Life of Marlborough* (1885), and many other literary works, and is a great authority in England on French literature.

Sakalavas, the aborigines of the west coast of Madagascar, a wild people little removed from the savage state, semi-independent of the Central Government, but without national coherence, and divided into a great many tribal groups, of which the most numerous are the Behisotra, Isimahety, Tandrona, and Antankaras; worship Zanahary, a great spirit dwelling on the mountain-tops, in the forests and rivers; type fundamentally Negro, modified by Malay and perhaps Arab elements; speech Malagasy, differing little from that of the Hovas (q.v.); population about 500,000 (A. Walen, *The Sakalava*, in *Antananarivo Annual*, 1884; Bishop Kestell-Cornish, *Tour in Madagascar*, p. 15).

Sakuntala, a female character of Hindu mythology whose story forms the subject of a drama. Heavenly nymphs used to descend to tempt the sages, and such a one overcame Viswanidra and bore him a daughter, Sakuntala.

After a time the mother returned to heaven, and the sage to religion, and the daughter was taken care of by another sage, who dwelt in a forest where reigned the princes of the Lunar line. A prince met her and married her with the sanction of the deities, and her son was founder of the race of Bhâratas.

Saladin, or SALAH-ED-DEEN, the great Sultan of Egypt and Syria, was born in 1137, and when about thirty years old went with his uncle to Egypt to fight the Crusaders. His great courage was soon displayed to advantage, and his uncle was made Grand Vizier, Saladin succeeding him. Gradually increasing his power, he was named sultan on the death of Nouredin in 1173, and soon signalled his prowess by the capture of Damascus, Aleppo, and other cities, entering the Holy Land in 1187, and totally defeating the Christians at Tiberias, under Guy de Lusignan, who was made prisoner. In October of the same year he took Jerusalem, and in November laid siege to Tyre without success. When the third crusade was started, Saladin had to meet Richard Cœur de Lion, who proved himself a formidable foe; and in 1192 a three years' truce was agreed to, but Saladin died in the following year. He was a man of noble character, moderate and benevolent, discouraging the murders and robberies of his followers, and building throughout Egypt, Syria, and Arabia, mosques, colleges, and hospitals.

Salamanca, a walled Spanish city of mediæval aspect, situated on hills overlooking the Tormes, 110 miles W.N.W. of Madrid. The University, one of the most renowned among mediæval places of learning, was founded in 1243, and continued to flourish till the latter part of the 17th century. In the 15th century its 25 colleges contained some 10,000 students. The buildings are, for the most part, in a late style of Gothic architecture. There are two cathedrals, the more ancient of which is a Romanesque structure of the 12th century. The Jesuit College was erected in 1614. Salamanca has a library containing upwards of 70,000 volumes, besides MSS. The great square, which is surrounded by colonnades, and was used as a bull-ring, is said to be the largest in Spain. The leather industry has declined, and the linen, cloth, and earthenware manufactures are not very extensive. Near here Wellington defeated Marmont in 1812.

Salamander, either of the two species of the genus *Salamandra*, type of a family (*Salamandridæ*) of tailed Amphibians. They are small, newt-like animals, from six to eight inches long, living on land when adult, and feeding on worms, molluscs, and insects. The Spotted Salamander (*S. maculosa*), from Europe and North Africa, is marked with large yellow patches on a black ground. Its young are born in the water and have gills. The Black Salamander (*S. atra*), found in the Alps, brings forth its young alive and breathing by lungs. Salamanders are falsely reputed venomous, and were fabled to be able to live in fire, and to extinguish it.

Salamis, the ancient name of Koluri, a mountainous island of Greece in the Saronic Gulf, off the N.W. coast of Attica. A war for its possession between Athens and Megara terminated in favour of the former towards the close of the 7th century B.C. The narrow strait between its eastern shore and the mainland was the scene of the great naval battle of the Persian War, in which the armament of Xerxes, containing 1,200 triremes and 3,000 smaller vessels, was completely vanquished by the combined fleets of the Athenians, Spartans, and Corinthians, numbering in all 366 triremes (480 B.C.).

Sal Ammoniac consists of chloride of ammonium NH_4Cl , a white solid which may be artificially prepared by the direct union of hydrochloric acid and ammonia, dense white fumes resulting from the combination of the two colourless gases. It has been known from early times. It was imported first from Asia, afterwards from Egypt, where it was prepared from camel's dung, and later it was manufactured by the distillation of horns, hoofs, etc. At the present time it is almost entirely obtained as a bye-product in the manufacture of coal-gas. The gas liquor, as it is called, contains large quantities of ammoniacal salts; it is heated with lime and the ammonia expelled and received in dilute hydrochloric acid. From the solution so formed the sal ammoniac is obtained pure by recrystallisation and sublimation. It forms colourless crystals of the regular system, frequently forming arborescent aggregations. As obtained by sublimation it is usually a tough fibrous mass. It is easily soluble in water, the solution possessing a sharp taste. It is used to a slight extent in medicine, and very largely in the dyeing industry, besides which it finds frequent application in the chemical laboratory.

Saldanha, DUKE OF (JOSÉ CARLOS SALDANHA DE OLIVIERA). Portuguese soldier and statesman, was born in 1791, served under Marshal Beresford in the Peninsula, and distinguished himself greatly during his military career. He became, in 1825, minister of foreign affairs and governor of Oporto, and fought bravely on the side of Isabella in the struggle between her partisans and those of Don Miguel. He was not so successful as a statesman, and made many blunders. He led the reactionary party, and between 1836 and 1846 was in exile. He was appointed later to the embassy at Rome, and in 1870 was Prime Minister of Portugal for a few months. He died in 1876, while ambassador at London.

Sale, the transfer of property from one person to another in consideration of a price or recompense in value—in other words, for a valuable consideration. The contract for sale in English law is a *real* contract, or in the nature of such, some tender or transfer being required to make the sale complete. There is this striking difference between the English and Roman law in the contract for sale, namely, that in the English law *the property* in a specific article (or in a non-specific article or unascertained bulk so soon as the same becomes specific or ascertained) passes to and rests in the

purchaser even before delivery, the vendor retaining only a lien on it while in his possession for the price; whereas in Roman law such property does not pass to the purchaser until after payment of the price and also delivery of the article (Benjamin on *Sales*).

Sale, BILL OF, a deed or writing under seal designed to furnish evidence of the sale of personal property. It is necessary to have a *Bill of Sale* when the property sold is not immediately transferred to the purchaser.

Sale, SIR ROBERT HENRY (1782–1865), one of the greatest of Anglo-Indian soldiers, entered the army in 1795, and, after going to India, served through the first Burmese War, rising rapidly in rank. From 1838 onwards he commanded the well-known 1st Bengal Brigade, and fought strenuously to extend the British power in India. In Afghanistan and after the revolt of 1841 against the British in Cabul he won many victories with his small body of men. During 1841–42 he was besieged at Jellalabad for six months, and heroically defended the garrison, finally issuing forth and completely routing the besiegers. He was killed at the battle of Moodkee. He was probably descended from the GEORGE SALE (1680–1736) who published the translation of the Koran in 1734.

Salem, the name of several towns in the United States, the most important being that on the E. coast of Massachusetts, 16 miles N.N.E. of Boston. It formerly carried on a large trade with the East, but at present the port sends out few ships except coasting vessels and whalers. On the other hand, its cotton, leather, and other manufactures are of recent growth. Nathaniel Hawthorne and W. H. Prescott were natives.

Salerno, an Italian city and seaport, on the N. side of the Gulf of Salerno, 33 miles S.E. of Naples by railway. In the latter part of the 11th century it fell into the hands of the Normans under Robert Guiscard, who fixed his court here and built the stately cathedral. This edifice, which has a façade of granite Corinthian pillars, is dedicated to St. Matthew, whose bones are said to have been brought hither in 954. In mediæval times the university was celebrated for its medical school. The silk manufacture is still carried on.

Salicin is a substance belonging to the group of compounds known as glucosides, which is found chiefly in the bark of various species of willow and poplar. It may be extracted from this source by means of water, and by crystallisation is obtained as bright colourless prisms which melt at 198°. It possesses a very bitter taste, and by the action of acids or certain natural ferments—*e.g.* emulsin—it splits up into glucose and salicylic alcohol. $C_{13}H_{18}O_7 + OH_2 = C_7H_8O_2 + C_6H_{12}O_6$.

Salicin, SALICYLIC ACID, SALICYLATE OF SODIUM. These drugs are largely employed in the treatment of joint affections, the salicylate of sodium being especially used in acute rheumatism (in doses of 10 or 20 grains). When the drug is administered in large doses, it produces buzzing in

the ears, deafness, perspiration, impairment of vision, and it may be even delirium.

Salicylic Acid, or ORTHO-OXYBENZOIC ACID, is represented by the chemical formula $C_6H_4(OH)CO_2H$, and consists of benzoic acid in which one of the hydrogen atoms has been replaced by the group OH (*hydroxyl*). It occurs naturally in the buds of some species of spiræa, and also combined with methyl alcohol in oil of wintergreen. It may be also prepared artificially by many chemical reactions, as by the action of carbonic acid and sodium on carbolic acid.



It forms four-sided prisms which melt at 156°. It is only slightly soluble in cold water, but readily in hot, so that it can be easily crystallised. If heated slowly it sublimes, but if heated rapidly decomposes. It is readily recognised by the production of a deep violet colour when ferric chloride is added to its aqueous solution. It is a good antiseptic and is used as such in surgery, while it also finds other medicinal applications.

Salic Law was the code which governed the Salian Franks, who founded the Frankish kingdom. In a stricter sense it is applied to the custom which makes a female ineligible to reign or hand on a right to the crown. This law obtained in France from the time of the Frankish Clovis to the end of the monarchy, and was used to bar the claim of Edward III. to the French Crown. A similar law is in force in most German states, and therefore Queen Victoria did not succeed to Hanover.

Salisbury, the county town of Wiltshire, is a cathedral city and municipal and parliamentary borough, situated in a valley at the confluence of the Avon, Wiley, Bourne, and Nadder, 83 miles W.S.W. of London by railway. The town is built on a regular plan, consisting of streets which cross at right angles, thus forming squares, called "The Chequers," with houses facing the thoroughfare and opening at the back into a court or garden. The glory of Salisbury is its cathedral (1220–58), which is a perfect specimen of Early English architecture, the tower and spire alone being additions of the Decorated period (1330–75). The building comprises a nave of 10 bays with aisles, a choir of 6 bays with aisles, two transepts, one with 4, the other with 3 bays in each wing, a Lady Chapel at the E. end, and a central tower with a spire of 400 ft. The external length of the cathedral is 473 ft., and its breadth 111 ft.; its height, measured from the inside, is 81 ft. Irreparable injury was done to the building by the "restorer" James Wyatt in 1782–91. The beautiful cloisters date from the latter part of the 13th century. Within the Close, which has an area of about half a square mile, stands the episcopal palace, a long, irregular, picturesque building with gardens opening into the cloisters, and round it are grouped several other interesting old houses. The Market Place, which occupies a central position, covers $2\frac{1}{2}$ acres, and has a handsome council-house (1795) at its S.E. angle, in front of which are statues of Sidney Herbert and

Professor Fawcett. The Blackmore Museum contains an unsurpassed collection of prehistoric remains. The "Halle of John Halle," a banqueting-room built in the latter part of the 15th century, is a very interesting example of the domestic architecture of the period. A solitary conical mound, a mile N. of the city, surrounded by ditches and massive earthen ramparts, is all that now marks the site of Old Sarum, an important Roman station and the seat of a bishopric from 1075 to 1220, when it was transferred to New Sarum or Salisbury. Salisbury Plain, in the midst of which the city stands, consists of undulating chalk downs, intersected by fertile and well-wooded valleys.

Salisbury, ROBERT, third MARQUIS OF (b. 1830), as Lord Robert Cecil made an early reputation as a brilliant writer and speaker. He was born at Hatfield and educated at Eton and Oxford, and in 1853 became M.P. for Stamford. He married the daughter of Baron Alderson in 1857, and was long a leading contributor to the *Saturday Review*. In 1865, on the death of his elder brother, he became Lord Cranborne and heir to the marquise, and in the following year was made Secretary of State for India in Lord Derby's Ministry, retiring in 1867 in consequence of Disraeli's Franchise Bill. Succeeding to the marquise in 1868, he went to the House of Lords, and in 1874 was again Secretary for India and later Foreign Secretary. He had been sent just before to Constantinople on an important mission, and in 1878 accompanied Disraeli to the Berlin Conference. He became Premier in 1885, and again after the defeat of the Home Rule Bill. He has written some excellent papers on chemistry. His *Speeches* have been collected and published.

Salivary Glands. [GLANDS.]

Sallust (P. SALLUSTIUS CRISPUS, 86-35 B.C.), Roman historian, was born at Amiternum, and in the year 52 became a member of the Senate, but two years later, owing to his immoralities, was expelled. He was a warm adherent of Cæsar, who restored him to his position. He became prætor-elect in 47, and accompanied Cæsar on his African expedition, being appointed governor of Numidia afterwards. He accumulated enormous wealth there by oppression and extortion, and returned to Rome to enjoy a life of luxury. He wrote a good deal, much of which is now lost, but his histories of the Jugurthine and Catiline Wars have survived, and are models of Latin composition. According to Mommsen they are written in Cæsar's interest, the latter to minimise his complicity in Catiline's conspiracy, and the former to glorify his relative Marius. Sallust was the precursor of Livy and Tacitus, and his style is commendably terse and forcible. He poses as a stern moralist in his writings, though his life was in many respects a shameless one. His historical works are among the earliest of the kind in Roman literature.

Salmasius (1588-1653), a great French scholar, whose real name was CLAUDE SAUMAISE, was the son of a learned writer, and was born at Saumur. He wrote Greek and Latin verse at an

early age, was devoted to study, and, without a master, taught himself Arabic, Hebrew, and other languages. He succeeded Scaliger as professor of history at Leyden, and was a friend of Casaubon, Grotius, and others. After completing his education at Paris and Heidelberg, he became a Protestant. He published in 1649 his defence of Charles I. of England, and was replied to by Milton, who in his *Defence of the People of England* entirely demolished the case of Salmasius. The latter replied, but his reply was not published till after his death. In 1650 he went to Sweden at the invitation of Queen Christina, who, however, neglected him after Milton's crushing rejoinder, and he is said to have died of disappointment. He was greatly admired as a scholar by his contemporaries, and Richelieu desired to keep him in France that he might write the history of his administration, but he told the Cardinal that his pen was not a venal one. His works number about fifty.

Salmon, a book name for fishes of the genus *Salmo*, type of the Physostomous family Salmonidæ, which also contains the trout, smelt, grayling, vendace, etc. The family has representatives in fresh and salt water, some migrating from one to the other; all food fishes, and most of them highly esteemed. The body is generally covered with scales, the head is naked, and there are no barbules. Behind the dorsal is an adipose fin—a mere fold of skin containing fat; the air-bladder is large and simple, and the spawn falls into the abdominal cavity before extrusion. In the type-genus the body is covered with small scales, the mouth-cleft is wide, and there are teeth on the jawbones, palatine bones, vomer and tongue. The anal fin is short. The young bear dark transverse bars, which disappear in the adults. This coloration has been compared to the spots of lion-cubs and some young deer. The geographical range of the genus is limited to the temperate and arctic zones of the northern hemisphere, their southernmost point in the Old World being the rivers of the Atlas and the Hindu Koosh, and in the New World the rivers falling into the head of the Gulf of California.

The Common Salmon (*Salmo salar*) is the largest and most valuable species of the genus, and the most shapely and beautiful of living fishes. On the upper surface the colour is bluish- or greenish-grey, fading into silvery-white below, and above the lateral line, which is nearly straight, there is a plentiful sprinkling of large black spots. The hinder edge of the gill-cover is rounded. Fish brought to market usually range from 20 lbs. to 40 lbs. in weight. Buckland noted one from the Tay that scaled 73 lbs., and specimens of from 83 lbs. to 93 lbs. are on record. Fish of such a size, however, are very rare, and will grow rarer, owing to the systematic way in which rivers are fished for the market. The adult male is easily distinguished from the female by the protrusion of the lower jaw, and in the breeding season this is developed into a kind of hook, which becomes a formidable weapon in combats with rivals, and

with its mortal injuries are sometimes inflicted. During the summer salmon are found along the coast and in estuaries, entering rivers about the autumn, though the time varies in different rivers, the temperature of the water being probably an important factor in the matter. As a general rule, salmon return to spawn in the rivers in which they were bred. The work of ascending to the upper reaches is often one of great difficulty. The fish move chiefly by night, and are able to pass over a perpendicular obstacle of about six feet in height. To afford them assistance in their journey, fish-ladders are fixed, which serve as landings or resting-places whence fresh leaps can be taken. On arriving at the spawning-ground the female sweeps away the gravel with her tail, and in the trench so formed deposits her ova, the male keeping guard the while. When she has finished her task he swims over the place shedding the milt which fertilises them. As soon as this is done a few sweeps of her tail cover the ova with gravel, and the spawning, which generally occupies about ten days, is completed, and the spent fish are ready to return to the sea. A period of from 90 to 120 days is required to hatch the eggs, but this term varies according to the temperature of the water, and is consequently longer in the Scotch than in the English salmon streams. The eggs, too, have many enemies, and but a very small proportion of the fry that come out ever reaches the sea. When born the young fish still bear the umbilical vesicle attached, and it is not absorbed for some weeks. The form of the fry is probably as well known as that of the full-grown fish, for the former are well-known microscopic "objects," readily obtainable from any dealer in such wares, and they will live and thrive in an aquarium where there is plenty of vegetation and an abundance of "water-fleas." Few descend to the sea in the first year. It was formerly thought that the migration was always delayed till the second year; but there is evidence that in fish artificially bred the migration of at least a part of them takes place earlier. On the return to fresh water the fish are generally sexually mature, and on their subsequent descent to the sea they assume the character of adults. In its different stages of growth the salmon has a variety of names. According to Dr. Day, "the fish in its full-grown condition is known as the *salmon*; one on its second return from the sea is often termed a *gerling* in the Severn, or a *botcher* on its first return, when under five pounds weight, although the more general designation is *grilse*; when under two pounds weight it is usually termed *salmon peal* by fishmongers. From one to two years before it has gone to the sea it is known as a *parr*, *pink*, *smolt*, *smelt*, *salmon-fry*, *sprag*, or *salmon-spring* (Northumberland), *samlet*, *brandling*, *fingerling*, *black-fin*, *blue-fin*, *shed*, *skegger*, *gravelling*, *hepper*, *laspring*, *gravel laspring*, *skerling*, or *sparling* in Wales. In Northumberland a milter or spawning male is known as a *summercock* or *gib-fish*, and a salmon as a *siuen*. In the Severn a salmon which has remained in fresh-water during the summer without going to the sea is a *laurel*. After spawning this fish is a *kelt* or *slat*,

but a male is generally termed a *kipper* and a female a *shedder* or *baggit*.

The Pacific Salmon belong to the closely-allied genus *Onchorhynchus*, differing only from the type-genus in the increased number of rays in the anal fin. There are five species, from the rivers of the North Pacific, the most important, the Quinnot or King Salmon (*O. quinnat*); the annual take of this fish in the Columbia river averages 30,000,000 lbs., of which a large proportion is canned for European markets; the Blue-back Salmon (*O. nerka*). The former reaches a weight of 100 lbs; that of the latter ranges from 4 lbs. to 8 lbs. The flesh of salmon is of a pinkish-orange colour, probably due to the crustaceans which form their principal food.

Salmonidæ. [SALMON.]

Salmon-Trout, SEA-TROUT (*Salmo trutta*), a valuable British food-fish, ranging from the south of England to Orkney and Shetland, and found in Wales and Ireland, where it is known as the White-Trout. It is closely allied to, but smaller than, the salmon, which it resembles in habit. The body is thicker than that of a salmon of the same length, and the hinder margin of the gill-cover is not so rounded. On their first return from the sea they present a silvery appearance, whence fish at this stage were sometimes made a distinct species (*S. albus*).

Salonica, SALONIKI, a city and port of Turkey in Europe situated at the head of the Gulf of Salonica, which bounds the peninsula of Chalkis on the west. The original name, Therma, was changed to Thessalonica by Cassander (B.C. 315), the founder of its importance and commercial prosperity, which was increased by the great Roman road from Dyrrachium (Durazzo) to Byzantium, the Via Egnatia, passing through it. The city is finely situated on the western slope of a hill in a fertile region. Its chief exports are corn, cotton, tobacco, and wool.

Salpa, one of the best-known genera of the Ascidiæ belonging to the order Thaliacea. It includes some free-swimming forms of interest, as they exhibit the phenomena of alternation of generations. There is an asexual generation or nurse consisting of a long stolon, upon which buds are developed; these are ultimately set free in a chain and developed into sexual forms; the chain is then broken up into single Salps.

Salsafy (*Tragopogon porrifolius*), or (from the taste) OYSTER-PLANT, a biennial vegetable, apparently native to Southern Europe, which was more cultivated formerly than now. It has long narrow tapering leaves; hollow peduncles thickened near the apex; and an involucre of eight bracts, longer than the purple or rose-coloured ligulate florets. The whole plant is glabrous. The fusiform tap-root has much milky latex and resembles the parsnip in flavour. This wholesome esculent belongs to the sub-order Ligulifloræ of the Compositæ.

Salt, the general name for sodium chloride (NaCl). It occurs either as *bay salt* from the artificial or recent evaporation of sea-water, or as *rock-salt*, in beds resulting from such natural evaporation in past geological times. In sea-water it varies in proportion from under 3 per cent. in polar seas to over 3·5 per cent. at the equator. This sea-salt is still the chief source of the salt of commerce in many dry countries such as France, Spain, Portugal, and Austria. Being generally impure, it is known in France as *sel gris* ("grey salt"). In its gradual concentration the sea-water deposits many of the double potassium and magnesium sulphates and chlorides which occur associated with rock-salt in the mines at Stassfurt in Saxony. Rock-salt occurs in beds of almost every geological formation, from the Salina group of the Silurian in Canada, the Permian of Middlesborough, Yorkshire, and the Hala (Salt) range in Sindh, and the Trias of Cheshire and Salzburg, to the Cretaceous of Wieliczka, in Galicia, and even more modern deposits. It is often associated with bitumen, and almost invariably with gypsum, and much salt is pumped to the surface as brine. This has led to extensive subsidences in Cheshire and elsewhere, and the formation of lakes or "meres." The salt occurs pure white, ochreous, blue, violet, green, or other colours, and crystallised in cubes or in hollow cubes of remarkable construction. [CRYSTAL.] It is 2 in the scale of hardness. We export over a million tons annually, mostly from Liverpool, India and the United States between them taking more than half that amount. As mineral or supplementary salt is not requisite to a dietary of milk and raw or roast meat, but is so to cereal or vegetable food, many primitive nomadic peoples have done without it, whilst its use has come in with agriculture. Salt thus also early became, and remains, an important article of commerce, many old trade routes being created by this traffic, such as that between Syria and the Persian Gulf by way of Palmyra, a place celebrated for its salt. Cakes of salt have been used as money in Abyssinia, in Thibet, and elsewhere, and Government monopolies or heavy taxes on the trade have been very general. Its value to health has invested it with a quasi-sacred character, so that Homer calls it "divine," and among many nations, ancient and modern, it is a sign of hospitality and of the bond of honour thereby created.

Salt, HENRY, the traveller (1785-1827), was the first European to enter Abyssinia for 250 years. He held some official appointments in the East, and wrote an interesting account of Abyssinia (1809-10).

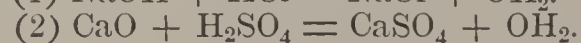
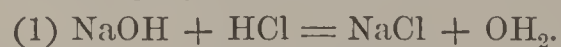
Salt, SIR TITUS, BART. (1803-76), philanthropist and founder of Saltaire in Yorkshire, is generally considered the discoverer of alpaca-wool, and certainly was the first to turn it to manufacturing uses. He created a splendid business at Saltaire, became M.P. for Bradford in 1859, and a baronet in 1869.

Salt Lake City, the capital of the State of Utah (q.v.), and the chief seat of the sect of the Mormons (q.v.). It is situated at the S.E. of the

Great Salt Lake, more than 4,000 feet above the sea-level, at the western base of the Wasatch Mountains, and has wide regular streets, with neat, spacious houses and fine public buildings.

Saltpetre. [NITRE.]

Salts. When an acid is gradually added to an alkaline substance the characteristic properties of the latter are slowly destroyed, those of the acid also disappearing, until finally a compound is obtained which possesses neither acid nor alkaline properties. Such compounds are termed *salts*. As many compounds which do not show alkaline properties also neutralise acids, a more complete statement is that *bases* (q.v.) and acids by uniting together form salts. Such a reaction is expressed by the following equations:—



It is seen that in the salts the hydrogen of the acid is replaced by the metal present in the base, so that in constitution salts are compounds formed from acids by the replacement of the hydrogen by a metal. Certain groups of elements (*e.g.* ammonium, NH_4) also behave as metals in this respect, forming salts, as ammonium chloride (NH_4Cl). In many acids, however, there is more than one atom of hydrogen present in the molecule. In such cases the hydrogen may or may not be completely replaced by the metal. In the former case the resulting salt is known as a *normal* or *neutral* salt—*e.g.* normal sodium sulphate (Na_2SO_4). If the replacement be incomplete *acid salts* result, as *e.g.* acid potassium sulphate (HKSO_4). These are also known as hydrogen salts, as *dihydrogen sodium phosphate* (H_2NaPO_4). In some salts also there is present a greater amount of the base than is necessary to combine with the acid, and we hence obtain *basic salts*. The term *salt*, or common salt, is applied popularly to the chloride of sodium (NaCl) [SODIUM], and was the original significance, the general term being due to an after extension of the meaning. In ordinary language and in medicine the term *salts* also is given to Epsom salts (q.v.), or sulphate of magnesium ($\text{MgSO}_4 \cdot 7\text{OH}_2$). A number of compounds also are known under such names as *salts of lemon*, *salts of sorrel*, etc. *Smelling salts* consist of carbonate of ammonia (which has a strong odour of the latter), usually mixed with some perfume as lavender, etc. In organic chemistry compounds strictly analogous to salts are abundant in which certain hydro-carbon radicals play the part of the metal. They are usually known as ethereal salts or as *esters*.

Saltwort, a name strictly applied to *Salsola Kali*, a British seaside plant belonging to the order Chenopodiaceæ, but often extended to the allied genus *Salicornia*. They take the name from growing upon "saltings," and were formerly largely used in the preparation of the ash known as *barilla*, an impure sodium carbonate used in the manufacture of glass and of soap, but now in the main superseded by the introduction of soda made from common salt.

Salvador, a small republic of Central America, W. of Nicaragua, and S. of Honduras and Guatemala. The interior is mountainous and volcanic, but the valleys and the slope down to the coast are very fertile. The main products are indigo, maize, cotton, tobacco, balsam of Peru, and cedar wood. The (Pacific) coast, 150 miles long, includes the Bay of Fonseca. The capital, San Salvador, was destroyed by an earthquake in 1873, but few lives were lost.

Salvage, the compensation allowed to persons by whose assistance a ship or boat, or the cargo of a ship or the lives of the persons belonging to her, are saved from danger or loss in cases of shipwreck, derelict, capture, and the like; and a salvor is he who renders such assistance. The assistance must be voluntary, and not under any contract or duty, and must involve skill, enterprise, and risk on the part of the salvors (*see* the Merchant Shipping Act, 1854). The right to salvage may be forfeited, either totally or partially, by misconduct on the part of the salvors, but the evidence of misconduct must be conclusive. A towing-ship, if it render salvage services, will be entitled to salvage reward like any other ship. Similarly, one of the vessels which have been in collision may, if the innocent party, be entitled to salvage for services rendered to the other party, but not so if both ships were equally at fault.

Salvation Army had its origin in a mission started at the East End of London in 1865 by Mr. William Booth, and having for its object the carrying of religion to the poor and outcast. It took its name of "Army" and its quasi-military organisation in 1878. In tenets it somewhat resembles Wesleyanism, and its methods and social aims are well known; and doubtless the military dress and musical accompaniments attract many, while its undoubtedly good and benevolent acts have gained for it a certain amount of respect. Mrs. Booth was greatly instrumental in its success.

Salvini, TOMMASO (b. 1830), tragedian, is a native of Milan, and of histrionic descent. His first engagement was with Madame Ristori's company, when his power was soon recognised. His career was somewhat interrupted by the Italian War of Independence, through which he served, but his assumption of the part of Othello in 1857 gave him his great chance. Since then he has played throughout Europe and in America, and in England, as elsewhere, is accepted as a splendid tragic actor.

Salzburg, a cathedral city of Austria, beautifully situated on the Salzach, at the mouth of a valley at the foot of the Austrian Alps, with a fertile plain to the west and south. The fortress is built on a ridge of rock with precipitous sides which rises from the valley. The chief manufacture is hardware. This city was the home of Mozart. There is a fine cathedral, interesting churches, a valuable library containing 82,000 volumes, and various parks, drives, and promenades. The crown-land of Salzburg is an irregular

triangle intruded into on the west by the south-east corner of Bavaria, the capital city lying near the



SALZBURG.

Frith & Co., Reigate, phot.

apex to the north, and the main ridge of the Austrian Alps forming the base to the south.

Salzkammergut, a name of the wooded and mountainous region of Austria between Styria on the east and Salzburg on the west, of which the chief productions are salt and timber.

Samara, a dry winged syncarpous fruit. It may be *single*, as in the ash, elm, or birch; or *double*, or rarely *triple*, as in the maples, and the wings may be lateral or almost all round the seed-cavity. Though the double samara breaks in half, it does not, whether double or single, split so as to disclose its seeds. The wing serves to disperse the contained seed away from the shade of its parent plant, those of the sycamore spinning round in the wind when falling from the tree like a screw-propeller. The wing in this and similar groups is sometimes elaborately shaped like a screw-propeller so as best to serve this purpose.

Samarcand, an important city of Bokhara, a centre of the inland commerce of Asia, and a seat of Mohammedan learning. It contains a large number of mosques and forty *madrasas* or theological colleges. Under the name Marakanda it was the capital of Sogdiana, and afterwards became the capital of Tamerlane's vast empire.

Samaria, a city of Palestine, which gave its name to the district between Judæa and Galilee. It was founded by Omri, about 922 B.C., and became the capital of the kingdom of Israel. About 720 B.C. Shalmaneser replaced the inhabitants by Assyrian settlers, many of whom were converted to the worship of Jehovah by a priest of the tribe of Levi. When the temple at Jerusalem was rebuilt, the Samaritans offered to aid the Jews, but met with a refusal, which led to bitter

religious animosity between Samaritans and Jews. John Hyrcanus destroyed the city, as well as the Samaritan temple on Mount Gerizim, near Sichem, in 129 B.C. It was soon rebuilt, and, under Herod, acquired some importance, but has since dwindled into a mean village.

Samaritans, a small Israelitish community of Nablus (Neapolis, Sichem) at the north foot of the sacred Mount Gerizim, Samaria. They claim direct descent from the old Israelitish inhabitants of Palestine, and profess a primitive form of the Hebrew religion, as embodied in a very ancient version of the Pentateuch in a Semitic language formerly current in Samaria, but modified by numerous Hebrew and Aramaic elements, and written in a Phœnician script which appears to have been in use in Palestine under the Maccabees. The MS., which is of great age, is preserved at Nablus with some other venerable documents. The Samaritans rigorously observe the prescriptions of the law, are strict Sabbatarians, and still offer sacrifices on Gerizim according to the rites ordained in Leviticus and Deuteronomy. They also, like the Jews, await the Messiah, who is to descend on the holy mountain, rival of Zion, and lead the faithful into everlasting bliss; but meantime the faithful are dying out, having been reduced in 1881 to 98 men and 62 women. (*Reports, Palestine Exploration Fund, July, 1881.*)

Samnites, a people of ancient Italy, who inhabited Samnium (*i.e.* Sabinum), which bordered on Campania and Apulia. They were originally a band of Sabines who emigrated earlier than the foundation of Rome, conquered the original Opicians, and adopted their language. Their warlike nature and love of freedom made them formidable enemies of the Romans. The first Samnite War—undertaken by the Romans in aid of Campania—began in 343 B.C., the second in 327 B.C. In 321 the Samnites, aided by neighbouring tribes, gave the Romans a severe check, but in 290 B.C. Roman supremacy was established. In 90 B.C. a revolt of the Samnites was followed by an almost universal massacre, and their career as a nation was ended.

Samoa, the largest of a group of small islands in the South Pacific, north-east of Fiji. The group is also called Navigator's Islands. The natives are Christian. The trade is chiefly in the hands of one German firm. After much friction between its representatives, other foreigners, and the native factions, a joint protectorate by Germany, England, and the United States was arranged in 1889. This, however, proved unsatisfactory, and New Zealand offered to administer the islands, 1894. The hurricane of 1889 is memorable for the escape of H.M.S. *Calliope*. (*See R. L. Stevenson's Footnote to History.*)

Samos, a mountainous island of the Archipelago lying near Cape St. Maria in Asia Minor, which has always been noted for its fertility. Its earliest inhabitants are said to have been Carians and Leleges, but it was colonised by Æolians from Lesbos and Ionians from Epidaurus. The Ionian element soon predominated, and the island was a powerful member of the Ionic confederacy. It

acquired considerable maritime power, planted colonies in Asia Minor, Thrace, Crete, Sicily, and Italy, and, under the tyrant Polycrates (*q.v.*), established an extensive trade with Egypt and Cyrene. It became subject alternately to Persia and Athens, until it was nominally attached to the Græco-Syrian monarchy. It joined Mithradates against Rome, and consequently became absorbed in the Roman Empire in 84 B.C. The island became tributary to Arabs, Venetians, Genoese, and eventually to the Turkish Empire. In the early period of Hellenic history Samos was famous for the special cult of Hera (Juno), for art, and in particular for the invention of casting in bronze, and generally for the highest Ionian civilisation. Towards the end of the Peloponnesian War this island became the asylum of the democratic party of Athens. From 1821 to 1824 the Samians maintained a successful resistance against the Turks. In the fifth century B.C. the capital city (Samos) was one of the finest cities of the world, and extensive ruins still mark its site.

Samothrace, SAMOTHRAKI, an island off the mouth of the river Maritza in Thrace, famous in early times for the mysteries of the Cabiri and afterwards of the Diocurvi. The centre is occupied by a lofty mountain.

Samoyedes, a main division of the Ural-Altaic family, closely allied in speech to the Finnish branch; their original home appears to have been the district about the sources of the Yenisei river, west of Lake Baikal, where they are still represented by the Soyot people, and whence they have spread as breeders of reindeer to the shores of the Frozen Ocean from the White Sea to Chatanga Bay; chief tribes, Yurak, Taguri, Ostyak, Abator, Koibal, with collective population about 20,000; are of coarse Mongolic type, low stature, squat ungainly figure, long jet-black hair, scant beard, broad flat features, high cheek-bones, long narrow and slightly oblique eyes, dirty-yellow complexion. All are nomads, fishers, and hunters, living in little rectangular birchwood huts in winter (*yûrts*), and in cone-shaped tents of birch-bark in summer (*chums*). Are nominal Christians of the Orthodox Greek rite, but still essentially Shamanists, worshipping the old stone idols and believing in the good and bad principles (*Sam-nûm* and *Vézako*). Despite their wretched savage existence, they possess a rich oral literature, myths, folklore and songs, many of which have been collected by Castrèn; are dying out. (Castrèn, Rae, Sommer, Rabot.)

Samphire, a succulent umbelliferous plant (*Crithmum maritimum*), growing on rocky sea-coasts whence it was originally known in French as *perce-pierre*. This was corrupted to *Saint Pierre*, whence the English name is derived. Its flowers are greenish-yellow, and its leaves are bi-ternate. These last are gathered, before the appearance of the flowers in June, for pickling, and were formerly valued as a digestive. The plant occurs on most European coasts, just above highwater-mark. Its collection for pickling is alluded to in *King Lear* (act iv. scene 6).

Samson, the liberator of Israel, was of the tribe of Dan, and was born 1155 B.C. His many exploits are recounted in the Book of Judges, he having been a judge for twenty years. His strength lay in his hair, and Delilah betrayed him into the hands of the Philistines by cutting it off. He was taken into the temple of the god Dagon, and pulled the edifice down on himself and his enemies in the year 1117 B.C.

Samuel, judge and prophet of Israel, was the son of Elkanah of the tribe of Levi, and was born about 1155 B.C. He was made a judge when he was about forty years of age, as related in the Scriptures, and consecrated Saul. The latter angered him by sparing the Amalekites on one occasion, and he warned him of the evil consequences of showing mercy to the enemies of the Lord. Samuel consecrated David afterwards, and died in the year 1057 B.C. He is supposed to be the author of the Book of Judges in the Old Testament and also of the First Book of Kings.

Samuel, BOOKS OF, received this name at the time of making the Septuagint translation, previous to which they, or rather it (for the Hebrew MSS. is one), was called the Book of Kings. The first part deals with the history of Samuel, and the latter with that of Saul and David, who were appointed by Samuel. Generally they may be said to give the history from Eli to the death of David, and may have been begun by Samuel, and perhaps continued by Gad, Nathan, and later writers.

San Antonio, one of the Cape de Verde Islands, 15 miles from St. Vincent. The population mainly consists of impoverished negroes, though the island is very fertile.

Sanchoniathon, a somewhat shadowy Phœnician historian, who is said to have lived in the 2nd or 3rd century before Christ. The literature of Phœnicia had perished before advancing Greek thought and energy, and was considered irrecoverable. Sanchoniathon was cited by Porphyry when he attacked the Mosaic account, and Philo Byblius, who had translated the fragments known as *The History of Phœnicia*, and assumed to be Sanchoniathon's, into Greek, vouched for the authenticity. Philo's character for honesty was considerable, but many scholars believe the work to be a forgery. Philo says Sanchoniathon was a native of Berytus, and lived in the reign of Semiramis. That such a writer existed seems clear, his name being held in reverence in ancient times, but there is grave doubt as to his *History*, which would be of immense importance if quite genuine. Philo may either have worked upon some real fragments of Sanchoniathon's writing, or he may himself have been deceived by a forger.

Sancroft, WILLIAM (1616-93), Archbishop of Canterbury, was born in Suffolk, and graduated at Cambridge. He was made Dean of York in 1664, and later Dean of St. Paul's, and in 1677 was raised to the see of Canterbury. He was a man of much power and great obstinacy, and was one of the seven bishops who were sent to the Tower for drawing up the petition against the illegalities of

James II. He took a prominent part in the events which followed the flight of James and the arrival of the Prince of Orange. In 1691, for refusing to take the oaths to William and Mary, he was deprived of his see, but absolutely declined to leave Lambeth Palace. When finally obliged to retire to his native place, he endeavoured to set up a new Church.

Sanctuary denotes the exemption from pursuit and legal process enjoyed by certain spots or buildings, notably churches. The Hebrews had their cities of refuge, some heathen temples had right of sanctuary, and from the time of Constantine certain churches were thus privileged. The rights were modified by varying conditions, and seem to have originated in the desire to insure against an anticipation of the result of judicial process. A Papal Bull was necessary generally to constitute, but the king's consent was in some cases enough. Sanctuary from debt was afforded by certain places in England till 8 & 9 William IV., general sanctuary having been abolished by 21 Jac. I. Holyrood with its precincts still gives immunity from debt.

Sand, finely-divided quartz, with admixtures of other substances, accumulated by various agencies. The grains may be perfectly regular crystals of quartz; angular fragments freshly derived from the breaking up of granite or schist; water-worn and rounded; chemically corroded; or with a redeposited coating of silica. No sand in any quantity is formed of flint. The other constituent minerals of igneous rocks, such as scales of mica, tourmaline, epidote, garnets, cassiterite, etc., often occur in sands, as does also finely-divided shelly calcareous matter. The name "sand" is sometimes loosely applied to the ground-down coral and nullipores of the shores of the Bahamas and Bermudas. Sand may be accumulated by wind, rivers, lakes, glaciers, or the sea; and, in the absence of fossils, it is well-nigh impossible to distinguish sands that have originated in one of these ways from those originating in another. Sands are generally poor in fossils, as their porous character leads to the destruction of any they may contain, by percolation. They are commonly stained red or yellow by oxide of iron; but may be green from the presence of glauconite (q.v.); lilac from that of humus acid compounds; grey from carbonaceous matter; or bleached to *silver sand* by the reducing action of organic acids. Among our chief English formations of loose sand are the Trias, the Portland Sands, the Hastings (including the Ashdown and Tunbridge Wells) Sands, the Lower Greensand (including the Sandgate and Folkestone series and some of the Hythe beds), the Upper Greensand, more commonly incoherent, the Thanet Sands, and the Bagshot Sands. Sand is employed for many commercial purposes, for glass-making, for making mortar, for earthenware, for foundry-moulds, for the cultivating of ferns and for scouring, whilst it was formerly put down on brick floors.

Sand, GEORGE (1804-76), a notable French novelist, was the daughter of a French officer named Dupin, and was born in Paris. Her real

name was Armandine Lucile Aurore Dupin previous to her marriage with M. Dudevant. She imbibed some of Rousseau's doctrines at an early age, and in 1817 entered the convent of the English Augustines in Paris, where she stayed three years. Her earlier life was spent with her grandmother in the country, and on the latter's death she married, but her wedded life was not a happy one, and they were separated, she taking charge of the two children. In 1831 or thereabouts she made the acquaintance of Jules Sandeau, and, having previously written a little for the press, she collaborated with him in a novel, which was published (1831) under the pseudonym of "Jules Sand." Her own first novel, *Indiana*, appeared in 1832 over the name of "George Sand." Having made some reputation, she settled down to literary work, and produced many novels in rapid succession. Having met with Alfred de Musset she went to Italy with him, and afterwards formed *liaisons* with other famous men, especially Chopin the musician, with whom she remained eight years. During the Revolution of 1848 she was concerned in political affairs, and her pen was devoted to them rather than to novels. Her very impressionable nature was stirred by certain mystical phenomena, and she has left in many of her novels a strong evidence of the religious or spiritualistic bent of her mind. *Spiridion* (1839) is especially marked by this exaltation. *Consuelo* appeared in 1842, and other novels of hers deserving of mention are *La Comtesse de Rudolstadt* (1843), *Le Meunier d'Angibault* (1845), *La Mare du Diable* (1846), one of her most beautiful productions, *La Petite Fadette* (1848), besides *Jean de la Roche*, *Mauprat*, *La Daniella*, *Histoire de ma Vie* (1854), and *Impressions et Souvenirs* (1873). Her most successful play is *Le Marquis de Villemer* (1864). The beauty of her style is one of her chief merits.

Sandalwood, the fragrant heart-wood of trees belonging to the genera *Santalum* and *Fusanus* of the order Santalaceæ among the Incompletæ (q.v.). *S. album* of India, whence £70,000 worth is exported annually, is the source of the chief supply. *S. Freycinetianum* and *S. pyrularium* in Hawaii, *Fusanus spicatus* in West Australia and other species are apparently inferior. 100 lb. of good sandalwood should yield from 25 to 30 oz. of a pale straw-coloured essential oil; but this, owing to its costliness, is largely adulterated. Indian sandalwood is chiefly produced in Mysore, and is worth from £12 to £40 per ton in China. It is extensively used for carving and inlaying, and, wherever Buddhism prevails, for burning in funeral and other religious rites. The oil is used as a perfume, and of late years as a substitute for copaiba (q.v.) in treating diseases of the mucous membrane. *Red Sandalwood*, or *Red Sanders Wood*, used in dyeing and calico-printing, is the red heart-wood of the leguminous *Pterocarpus santalinus*, and of the "padouk" (*P. indicus*) of the East Indies; and *barwood* or *camwood*, the *santal rouge d'Afrique* of the French, is that of *Baphia nitida* (*P. angolensis*) from the Guinea coast. The name is a corruption of *Santal wood*.

Sandarach, the mastic-like resin which exudes from the coniferous *Callitris quadrivalvis* of the Atlas Mountains, from *C. sinensis* in China, and from *C. verrucosa*, *C. robusta*, *C. cupressiformis*, and *C. Reissii*, known as "pine gum" in Australia. It is an important ingredient in spirit-varnishes. It is chiefly shipped from Mogador.

Sand-blasting, a method of engraving or cutting glass or any other hard substance by blowing with great violence minute particles of sand upon it. It is frequently used for engraving marble and also for sharpening files.

Sandby, PAUL (1725-1809), a distinguished painter and engraver, was born at Nottingham, and made many journeys in Wales and Scotland after completing his art studies, and the drawings executed by him were engraved in an original manner upon copper; but he specially excelled as a water-colour painter, and many fine specimens of his work are in English galleries. He became a R.A. on the foundation of the Academy in 1768, and was in the same year appointed drawing-master at the Woolwich Military Institution.

Sandeau, LEONARD SYLVAIN JULES (1811-83), French novelist and dramatist, published his first novel in 1831 in conjunction with Madame Dudevant, who, taking the first part of his name, became "George Sand." He was at that time a law student, but gave himself up entirely to literary work. He produced a great many works, the best of his novels being *Mlle. de la Seiglière* (1848), afterwards dramatised with great success, and his most notable comedy being *Le Gendre de M. Poirier*, written in collaboration with Augier. He held various official appointments, and was made an Academician in 1858.

Sanderling (*Calidris arenaria*), the single species of a genus of birds of the Snipe family, in which the hind toe is absent. It breeds in the arctic regions, visiting Britain in autumn and leaving late in spring. The male is about eight inches long; its nuptial plumage is rufous with black markings, which turns to ash-grey in winter; the under parts are white.

Sanderson, JOHN SCOTT BURDON (b. 1828), an eminent physiologist, was born in the north of England, and studied at Edinburgh University, taking a medical degree. For a time he practised as a physician, but ultimately became professor of physiology at University College (1874-82). In the latter year he was appointed to the chair of physiology at Oxford, and is recognised as one of the greatest authorities in that science. His best-known works are his *Handbook of the Sphygmograph* (1867), *Handbook for the Physiological Laboratory* (1873), and his *Course of Practical Lectures* (1882).

Sand-Grouse, a small order (Pterocletes) of birds, with two genera, characteristic of the Ethiopian region and Asia. They are pre-eminently desert birds, and the plumage is protective—buff with darker markings. The wings are long and pointed, giving them great powers of flight; the

legs and toes are short. The genus *Pterocles*, with about a dozen species, is represented in Europe, *P. alchata* being known in Spain as the Ganga. The genus *Syrhaptes* is Asiatic. Pallas's Sand-grouse (*S. paradoxus*) wanders westwards at uncertain intervals in large flocks.

Sand-Martin. [SWALLOW.]

San Domingo, or HAYTI, or HISPANIOLA, a large mountainous island of the Antilles group (with wide plains in the S.E.), which extends 400 miles from E. to W. It is very fertile, producing sugar, cotton, cocoa, coffee, and valuable timber, and has great mineral wealth. In 1691 Spain ceded the western half of the island to France, in which arose a flourishing French colony. The insurrection of the negroes (1791) led to terrible bloodshed and ruin. The blacks, aided by yellow fever, withstood and finally repelled a British invasion (1793-98). In 1801 Hayti, which was then all subject to France, asserted its independence [TOUSSAINT L'OUVERTURE], and the French were vanquished by the negroes and disease. The negro chief Dessalines (1804) assumed the title of Emperor of Hayti. After various revolutions the French or western side of the island became the republic of Hayti, capital Port au Prince; while the eastern or Spanish portion became the republic of San Domingo, capital St. (or San) Domingo. This city, on the S.E. coast, is the oldest European settlement (founded 1502) in the New World. There seems little doubt that the population of the interior is tending to relapse into barbarism.

Sandpiper, a popular name for birds of the sub-family *Totaniæ* of the Snipe family (*Scelopacidæ*). The bill is straight, or has a slight upward curve, and the toes are joined at the base by a fold of skin. The popular name refers to their habit of frequenting wet and sandy places and to their piping note. They feed on small aquatic animals, which they take by probing in the sand with their bills, or catch in rock-pools or at the water's edge. They are very widely distributed, and their migration is generally extensive; the winter is usually spent in the extreme north. They are all of small size, with prettily-marked plumage, and are valued for the table. The Common Sandpiper (*Totanus hypoleucus*), about eight inches long, yellow-brown marked with black above and white below, is a summer visitor to Britain and Ireland. The Redshank (*T. calidris*), with a body about the size of a snipe's, with longer legs, is resident. The Spotted or Dusky Redshank (*T. fuseus*) is an occasional visitor, as are some other species. [CURLEW, DUNLIN, GREENSHANK, KNOT, RUFF, SANDERLING.] The Little Stint (*T. minuta*), the American Stint (*T. minutella*), and Temminck's Stint (*T. temmincki*) are occasional British visitors. The Phalaropes, which have the toes lobed like those of a coot and webbed at the base, are sometimes called Swimming Sandpipers. The Grey Phalarope (*Phalaropus fulicarius*) and the Red-necked Phalarope (*P. hyperboreus*) are rare visitors.

Sandstone, sand cemented either by mere pressure producing a welding of the quartz-grains, by carbonate of lime, by carbonate or oxide of

iron, or by silica. When coarse-grained, it is termed a *grit*. It is frequently flaggy from the presence of scales of mica. Those in the Old Red Sandstone of Caithness, Dundee, Arbroath, Cork, Kerry, etc., are among the oldest used in building. The Yorkshire flags, used for paving and for grindstones, and the Craigleith Stone, of which much of Edinburgh is built, belong to the Carboniferous system; the St. Bees Sandstone, used for Furness Abbey, is Permian; whilst some of the variegated or "bunter" sandstones of the Trias are false-bedded, and are only held together by cohesion due to pressure, but others are used in building. In the Hastings Sands highly-ferruginous sandstones, in former times the source of all our English iron, occur; in the Lower Greensand, besides the valuable siliceous limestone known as Kentish Rag, beds of rubbly sandstone known as *hassoek* are worked; and the Upper Greensand contains the valuable *fire-stone* used for furnaces, hearthstones, and building. In the loose sands of Eocene age, known as the Thanet Sands and the Bagshot Sands, the very compact and tough pure sandstone, known as *Sarsenstone*, from which most megalithic monuments in the south-east of England are made, is found in lines of large irregular nodular masses often left on the surface of the chalk. [TORRIDON SANDSTONE.]

Sandwich, the name of a group of thirteen islands in the North Pacific. The principal islands are Hawaii (containing the great active volcano, Mauna Loa), Maui, Oahu (containing the capital, Honolulu), Tauai, and Nihau. The native government was long a constitutional monarchy, but a "provisional" (Republican) Government was set up by Americans in 1893. Most of the population is Christian. The chief products are yams, breadfruit, and cocoanuts. [COOK, CAPTAIN.]

San Francisco, the chief city and port of California, situated on a noble land-locked bay below the lofty and beautiful range of La Sierra, which rises on the E. The old town occupied the north end of the tongue of land which forms the south-eastern side of the bay. Of late years the city has been immensely improved and extended. By sea it enjoys a vast trade and traffic with all countries, especially with the coasts and islands of the Pacific; and it is the western outlet of the great Union Pacific Railway, which terminates at Oakland opposite the city. There is a large Chinese quarter, much of the labour and retail trade being in the hands of Chinamen.

Sanhedrim (from a Greek word for *Council*) was the supreme court of the Jews in matters both civil and ecclesiastical, and existed in the time of the Maccabees and in the days of the New Testament. It was modelled on the Mosaic Council, and consisted of a President and seventy members, its members being chosen from among chief priests, elders, and scribes. In the days of Roman ascendancy the Sanhedrim could not inflict sentence of death without consent of the Governor. The seat of meeting was afterwards removed to Tiberias. In 1806 Napoleon I. summoned a Sanhedrim to regulate the affairs of the Jews.

Sanitation is the science of health, and the art of maintaining the public health and keeping off disease. The principles of sanitation, which are in many civilised communities enforced by



BALDWIN HOTEL, SAN FRANCISCO.

legal enactments, have reference generally to dwellings, food and drink, clothing, and cleanliness. With regard to dwellings, sanitation would insist upon good drainage, sufficient ventilation, and the allowance of a due proportion of air to each inhabitant, the avoidance of overcrowding, especially in sleeping apartments, and the maintenance of a proper degree of warmth. As to food, it forbids the eating of decaying or improperly-cooked matter, the avoidance of eating unripe or over-ripe fruit, the suppression of adulteration, and the like. With regard to clothing, it dictates the use of woollen materials, and such as best keep up an uniform degree of animal heat; with regard to cleanliness, it advocates a plentiful use of soap and water and other similar purifiers and disinfectants both for personal and domestic purposes. One great means of lessening disease is the isolation of all patients suffering from infectious complaints. It is not always easy to reconcile the claims of the public welfare with the rights of individual freedom. Vaccination has always been a cause of heart-burning and discontent, and compulsory registration and treatment of disease is by no means an universally welcome idea.

San José, a town of California south-east of San Francisco. Also the capital of the Central American state of Costa Rica.

San Juan de Puerto Rico, or PORTO RICO, a West Indian island of the Antilles group, lying to the east of San Domingo. It has a fine harbour. A ridge of mountains runs from east to west, on either side of which are woods and fertile valleys and plains.

Sankara, a Brahminical saint and teacher who flourished somewhere between 800 and 200 B.C., and was probably a native of Western India and a member of the Namburi caste. He led a roving life, visiting Kashmir, it is said, and dying very early at Kedarnath in the Himalayas. Many commentaries on the Sûtras, Bhagavad-gîtâ, and Upanishads are ascribed to him.

San Luis de Potosi, capital of the Mexican state of San Luis, is a well-built city about 350 miles N.W. of the city of Mexico. It has a cathedral, smelting works, cotton factories, railway workshops, and in 1863 was the seat of the government of Juarez (q.v.).

San Marino, name of a town and district of the kingdom of Italy, once part of the duchy of Urbino, now a nominally independent republic.

Sanquhar Declaration, a declaration issued by Richard Cameron (q.v.) at Sanquhar in 1680, in which he proclaimed war against the King of England, repudiated prelacy and monarchy, and avowed his intention of setting up some other form of government.

San Salvador. [BAHIA, SALVADOR.]

Sans Culottes ("The Breechless"), was a name given in derision in 1789 to the tag-rag and bobtail portion of the French revolutionists, and, like the similar derisive epithet *Les Gueux* ("The Beggars"), applied to the revolted inhabitants of the Netherlands at an earlier period, was afterwards adopted as a name of honour by those to whom it had been applied.

San Sebastiano. [RIO DE JANEIRO.]

Sanskrit, the mother-tongue of the Indic branch of the Aryan family, and, on the whole, the best preserved, though not in every respect the most primitive, of all Aryan languages, with nearest congeners Old Persian, Hellenic, and Lithuanian; it is the sacred and oldest literary language of the Hindus, who regard it as of divine origin, and therefore perfect, whence its name *samskrita* ("made perfect"). Three distinct periods: (1) Vedic (Khandas). language of the Hymns (1500 B.C. ?), of the Brahmanas (800 ?), and Sûtras (500); (2) literary language (Bhâshâ): Pânini's grammar (300 B.C. ?), Inscriptions of Kanishka and Rudradâman (1st and 2nd centuries A.D.), Renaissance literature (400 A.D.); (3) Vulgar language (Prâkrita): Gâthâ, Pâli, Magadhi, Mahârâshtri (50-500 A.D.), merging gradually in the Neo-Sanskritic, for which see GAURIAN. [For script see DEVANÂGARÎ.] Owing to its religious and literary importance, Sanskrit has never ceased to be cultivated by the Hindus, and has been extensively studied in Europe for its philological interest since the time of Sir William Jones, who first drew attention to its intimate relations with the classical languages of the West. Thus were laid the foundations of comparative philology, which as a science may be said to date from the "discovery" of Sanskrit.

Santa Anna, ANTONIO LOPEZ DE, was born at Jalapa, Mexico, in 1798, and, having entered the army, espoused the cause of Iturbide, whom he assisted in the capture of Vera Cruz (1821), but subsequently overthrew on account of his imperial pretensions. He established a republic, and took an active part in military operations against the Spaniards. Elected president in 1833, he was defeated and imprisoned three years later by the Texan party. He regained his position in 1846, but was forced to resign next year by the American generals Scott and Taylor, though he once more held office from 1853 to 1855. He resisted Maximilian, and was afterwards banished by Juarez, but returned on the death of his opponent, and died in 1876.

Santa Cruz (Spanish, "Holy Cross"), the name of many places, of which the principal is the most southerly of the Virgin Isles (West Indies). The chief exports are rum, sugar, and cotton. The port of Christianstadt is the capital of the Danish West Indies, the island having been ceded to Denmark in 1733.

Santa Fé (Spanish, "Holy Faith"), the capital of New Mexico, United States of America, between the Rocky Mountains and the eastern branch of the upper waters of the Rio Grande del Norte.

Santander, the name of a port and a province of Spain, on the south coast of the Bay of Biscay. The town exports a large amount of wool; and the province, which consists of deep valleys among rugged mountains, is rich in iron.

Santerre, ANTOINE JOSEPH, born in Paris in 1752, made a fortune as a brewer, and in 1789 had command of a battalion in the National Guard, assisting in the capture of the Bastille. Joining the Jacobins, he played a prominent part in the events of 1791 and '92, and was promoted to the rank of general of division. His utter failure in the War of La Vendée led to his recall and imprisonment. The *coup d'état* of the 9th Thermidor saved his life, but Napoleon declined to give him employment, though he restored him to his nominal rank. He died in 1809.

Santiago, the capital of Chili, situated on the river Mapocho, in a plain at the foot of the Andes, about 90 miles S.E. by E. of Valparaiso. Also a town in the north of the western division of the island of San Domingo.

Santonin. This drug is employed as an anthelmintic with a view to destroying the common round worm, and sometimes the threadworm. It is apt to produce disturbances of vision. The dose is 1 to 3 grains for a child.

Santorin, the ancient THERA, an island of the Greek Archipelago, about 70 miles nearly due north of Candia in Crete, almost entirely covered with pumice-stone, but highly cultivated. The principal town is Pyrgos. The chief product is wine.

São Francisco, a noble river of Eastern Brazil, which rises about 250 miles north-west of Rio, and flows roughly parallel to, and about 300

miles from, the coast for about 1,200 miles, then turning E.S.E. to its two mouths, of which one is too shallow for navigation and the other blocked by a bar, while cataracts and rapids occur frequently over its course. It has more than twelve considerable affluents. In its lower course it separates the provinces of Pernambuco and Bahia.

Saône, a river of France, which rises in the Vosges, and, flowing in a southerly direction, joins the Rhone at Lyons, after passing Châlons and Mâcon.

Saône, HAUTE-, a department of France, between that of Vosges on the north and those of Jura and Doubs. It consists of a basin drained by the Saône and Ognon. Vesoul is the capital.

Saône-et-Loire, a department of France to the south of that of Côte d'Or, and north of those of Loire and Rhone. The chief towns are Autun, Le Creuzot, Châlons, and Mâcon.

São Paulo, name of a town of Brazil, and of the province situated between Paraguay and the Atlantic, south of the provinces of Minas Geraes and Rio de Janeiro. The mountains yield very fine timber, and the slopes and plains are generally fertile, a large part of the area being drained and watered by the Rio de la Plata and some of its affluents. The capital, São Paulo, in the north-west of the province, is a few miles south of the Tropic of Capricorn. Behind it to the south rise mountain-chains, which run parallel to the coast.

Sap, a term of popular, rather than of scientific, vegetable physiology, applying to the various juices of plants. Firstly, the drops of water containing some soluble matter that form in the vacuoles of the protoplasm of young cells are known as the watery *cell-sap*. [CELL.] Secondly, the liquid food taken in by the roots from the soil, consisting of water with dissolved mineral matters, is known as the *unelaborated sap*. It is forced upwards in early spring by root-pressure, this being known as the *rise* or *ascent of the sap*. Its upward course, under the influence of root-pressure and, at a later stage, of transpiration, is by the vessels or tracheids in the young wood. Thirdly, the milky latex (q.v.) and other liquids, such as the contents of the sieve-tubes, which form part of the *elaborated sap*, and contain sugar, starch, albuminoid and other matters, the results of assimilation and metabolism, are also termed sap. Their course is towards all growing parts. This, together with the course of the unelaborated sap which is mainly upward, is mistakenly known as the *circulation of the sap*. As there is no heart or central pumping-station, and no return of liquid to its starting-point, there is no true circulation in plants.

Sapindaceæ, a large order of Dicotyledons, mostly trees and shrubs and chiefly tropical, though the maples and some others extend into temperate regions in the northern hemisphere. The leaves vary, being either scattered or opposite, and simple, pinnate, or palmate. There are four or five sepals; as many petals; twice as many, or seven or eight, stamens; a prominent hypogynous disk; and an

ovary of several one- or two-seeded chambers. The fruit is various, including the fleshy dehiscent capsule of the horse-chestnut and buck-eyes, and the double samaras of the maples. The seeds may be exalbuminous or albuminous, and the soap-nut (*Sapindus*), from which the order takes its name, is specially remarkable for its saponaceous character. Even the seeds of the horse-chestnut produce a slight lather with water. [HORSE-CHESTNUT, MAPLE, SYCAMORE, ETC.]

Saponification. Soaps (q.v.) consist of compounds of certain organic acids with the alkaline bases. The process by which the fats are broken up into the alcohol and acids of which they are formed during the soap-formation is known as saponification. It is, however, also extended to all other similar reactions in which an ethereal salt is broken up into its constituent acid and alcohol. Saponification may be induced by the action of acids or alkalies, and the rate at which it proceeds in different conditions has been the subject of much investigation, and assisted greatly in the building up of the fabric of chemical dynamics.

Sapphire, the crystalline mineral form of the sesquioxide of aluminium (Al_2O_3). It crystallises in the Hexagonal system, but its crystals, as usually found in alluvial deposits, are water-worn. It varies in colour, being black and opaque in the impure ferruginous variety known as *emery*, reddish-brown or white and opaque in *corundum*, red and transparent in the *Oriental ruby* (q.v.), violet in *Oriental amethyst*, colourless in *lux sapphire*, and blue in the variety to which the name *sapphire* is popularly restricted. This blue variety is dichroic, the velvety cornflower blue of a fine stone being resolved by the dichroscope into ultramarine-blue and yellowish-green. Its colour may be due to cobalt-oxide, which is always used in imitating it. Its specific gravity is 3.9 to 4.1, and its hardness is 9 in Von Mohs' scale, but blue sapphire is harder than emery, corundum; or ruby. It is unaffected by acids, but is fusible with difficulty in borax or microcosmic salt, forming a clear bead. Sapphires occur in the basalts of the Rhine Valley; rarely in North Carolina, where coarse corundum is abundant; in Victoria and New South Wales, associated with gold; in Siam; with the ruby in Burma; but in the finest quality in Ceylon, in river sand. Some of these Cingalese stones are cloudy and when cut *en cabochon*, i.e. hemispherically, exhibit a six-rayed star or *asterias*. These are termed *star-sapphires*. The sapphire has been formed artificially, the most successful process being that of MM. Frémy and Feil in 1878.

Sappho, or PSAPHO, was born in the Æolic island of Lesbos probably towards the end of the 7th century B.C. She was certainly a contemporary of Alcæus, for fragments of an ode of his addressed to her and of her reply are still extant. Little is known for certain of her personal history, and the legend of her leap from the Leucadian promontory owing to her hopeless love for Phaon may be dismissed as untrustworthy. Her productions, all lyrical, were arranged in nine books, and they

ranked in the estimation of antiquity next to the immortal works of Homer. The disjointed scraps that have come down to us seem to justify this praise. She has given her name to the Sapphic metre.

Saprophytes (named from the Greek *sapros*, "rotten"), are plants which grow and feed upon decaying organic matter, often upon dead or decaying leaves. Though most green plants are probably in part saprophytic, and there are transition cases of plants partly saprophytic, typical saprophytes contain no chlorophyll. Among fungi (q.v.) many moulds, agarics, and other forms are saprophytic, whilst others are parasitic or either saprophytic or parasitic. Among Monocotyledons the bird's-nest and coral-root orchids are marked examples of saprophytism, parasitism being unknown in this class. Among Dicotyledons the toothwort (*Lathræa squamaria*) is partly saprophytic and partly parasitic, and the insectivorous Sarraceniaceæ and *Utricularia*, since they have apparently no digestive process, must also be classed as saprophytes. It is noteworthy that in their case, as in that of the toothwort, the absorbent organs are gland-studded leaf-structures. In both the saprophytic orchids and in *Lathræa* the leaves are reduced to brownish scales.

Saracens, or EASTERN PEOPLE, was the name given to the Arabs in Europe, though by the Crusaders it was widened to denote all the non-Christian races or nations with whom they came in contact.

Saragossa, the capital of Aragon in Spain, is situated on the Ebro. The city is chiefly noteworthy for an image of the Virgin to which pilgrimages are made, and for the marvellous sieges by the French (1808-9), in which the Spaniards under Palafox made one successful and two glorious defences, only succumbing at last to disease.

Sarasate, PABLO MARTIN MELITON, was born at Pampeluna, Spain, in 1844, and at the age of twelve began his training as a violinist at the Paris Conservatoire. In 1860 he made the tour of Europe and America, not appearing in London, however, until 1874, when he established lasting popularity. He is the author of several graceful compositions.

Saratoff, a town in South Russia on the west bank of the Volga. It gives its name to a government, through the middle of which, along the course of the Volga, runs a line of heights which divides the valley of the Volga from the water system of the Don. To the east of the Volga the province is mostly barren steppes, in many places covered with saline deposits.

Saratoga, the capital of Saratoga county in New York State, thirty miles N.E. of Albany and close to the health-resort of Saratoga Springs. Here General Burgoyne surrendered in 1777.

Sarawak, a town in the west of Borneo on a river of the same name. The district is rich in minerals and tropical products. [BROOKE, SIR JAMES.]

Sarcina, a schizomycetous fungus occurring in the human stomach, especially in cases of cancer, when it is brought up in the vomit. It also occurs in similar cases in the urine of men and of animals. Its cells divide in three planes at right angles, and thus remain in minute quadrilateral groups.

Sarcine. [HYPOXANTHINE.]

Sarcophagus ("flesh-devourer"), was the name given to a coffin made of a kind of limestone found at Assos in Asia Minor, and which had the reputation of burning up a body put within it in the space of 40 days, its action apparently being like that of quicklime. The name was afterwards applied to any stone coffin, and such coffins have been used by Egypt, Phœnicia, Etruria, Greece, Rome, and Christendom. Specimens exist in the British and other Museums.

Sard, a brown variety of chalcedony (q.v.) passing into carnelian (q.v.). Its name is probably connected with the Persian *sered*, a yellowish-red.

Sardine (French = "pilchard"), a trade name for young pilchards, prepared chiefly in France and Portugal by drying and salting and immersion in boiling oil. The fish are then put up in oil in tin cases for the market. Tomatoes and lemon are sometimes added. Sardines cured in red wine are sold as *anehoried* sardines. [PILCHARD.]

Sardinia, a large island pertaining to the kingdom of Italy, lying south of Corsica, from which it is separated by the Straits of Bonifacio. The chief towns are Cagliari, the capital, on the south, Sassari on the north, and Oristagno on the west. The surface of the island is diversified by numerous hills and valleys, and the soil is fruitful. The chief export is salt, and round the coasts there are extensive fisheries. Several dialects of Italian are spoken, some being mixed with Spanish. After passing under many dominations, the island was in 1720 ceded by Spain to the duchy of Savoy, and so became part of the kingdom of Italy in 1859.

Sardis, the ancient capital of the Lydian monarchy, a few miles N. of Mt. Tmolus (Kisika Mousa Dag), on the river Pactolus, an affluent of the Hermus. After the capture by Cyrus it was the seat of a Persian satrapy. The Greeks burnt it in 500 B.C. Then an earthquake destroyed it in the time of Tiberius, but he restored it. Only ruins and small villages now mark its site, as it suffered from Goths in 400 A.D. and successive invaders.

Sardonix, a variety of onyx (q.v.), or banded chalcedony, consisting of white or blue-grey layers alternating with red (carnelian) or brown (sard), or of all three superposed. When well and sharply coloured it is termed *Oriental sardonix*; but the colours are often heightened artificially, or the sardonix is built up of cemented layers of various chalcedonies. It has always been a favourite material for cameo-engraving, the finest, such as the *Triumph of Bacchus and Ceres* in the Vatican Museum, which measures 16 inches by 12 inches, being cut in stone of five different layers.

Sardou, VICTORIEN, was born in 1831. Educated for the medical profession, he was compelled

by poverty to take to writing and teaching for a livelihood. In 1854 he produced a comedy, *La Taverne des Étudiants*, which failed utterly. In 1859 appeared *Les Premières Armes de Figaro*, and its success was followed up later in the year by *Les Gens Nerveux* at the Palais Royal. Among his best-known pieces are *Les Pattes de Mouche*, *Nos Intimes*, *La Famille Benoiton*, *Divorçons*, *Fédora*, *Théodora* and more recently *Madame Sans-Gêne*. In 1877 he was elected an Academician.

Sark, or SERCQ, a small island in the English Channel, six miles east of Guernsey, belonging to England. It was at various times a stronghold of pirates, and was occupied successively by French and English. In Elizabeth's reign Philip de Carteret, of St. Ouen, founded a colony and held the island as tenant of the British Crown. Since then it has several times changed hands, but remains a curious survival of a mediæval Norman manor under its Seigneur. Mr. Swinburne and others have celebrated the coast scenery.

Sarpi, PIETRO, born at Venice in 1552, entered at an early age the Servite order of Augustinians, and was known as Fra Paolo. He soon made a name, not only as a theologian, but also as a mathematician and orientalist, obtaining a professorship in a convent at his native place. From 1579 to 1588 he was at Rome on the business of his order. Until 1605 his life was passed in quiet study. He then plunged into the disputes between Paul V. and the Venetian Republic, was excommunicated, and all but killed by assassins in 1607. With broken health he retired to his cloister, and composed the powerful works on which his fame now rests, though he never avowed their authorship—viz. *The History of the Council of Trent* (first published in England), *The History of Ecclesiastical Benefices*, and the treatise concerning *The Inquisition*. He died in 1623.

Sarracenia, a small genus of North American plants known as side-saddle flowers, the type of the order Sarraceniaceæ, a dicotyledonous family allied to the water-lilies. There are six or seven species and various hybrids, inhabiting the swamps of the Mississippi Valley and extending into Canada. They have a rosette of pitcher-shaped radical leaves and solitary flowers. The pitchers have a honey-secreting external flange, and secrete water in which insects are drowned. Downward-pointing hairs detain these insects, and glands on the lower part of the inner surface absorb the products of their decay. There is no true digestion. Moths lay eggs in the putrefying mass, the stench from which, where these plants cover acres of swamp, is unbearable; and birds slit the rotting pitchers for the sake of the maggots, so that probably a large portion of the organic matter is absorbed as a manure by the roots. The flowers have five imbricate sepals, five petals, numerous hypogynous stamens, and a five-chambered ovary, the umbrella-like expansion of its style giving the plant its popular name. *S. purpurea* is half-hardy, and the other species are greenhouse plants. The allied monotypic genera *Darlingtonia* and *Heliamphora* inhabit California and British Guiana respectively.

Sarsaparilla, the long fibrous rhizomes and roots of several species of the genus *Smilax*, a group of prickly climbing shrubs, with cordate, net-veined leaves and stipular tendrils, natives of the tropics, the type of a sub-order of Liliaceæ. The flowers are dioecious, and the plants grow in swampy forest-regions little visited by Europeans, so that there is some doubt about the species; but Mexican sarsaparilla is believed to be produced by *S. medica*, and the "Jamaica" sarsaparilla from Guatemala and Columbia, formerly shipped from Jamaica, by *S. officinalis*. The former is known as "mealy" from an abundance of starchy matter under the rind; the latter, the most esteemed, as "red-bearded," from the colour of the rootlets. Other commercial varieties are Lima, Honduras, Guatemala, and Guayaquil sarsaparillas. When boiled, the roots yield an extract, the quantity and acidity of which is the test of the quality of the sample. In addition to starch, resin, and oxalate of lime, there is a crystallisable neutral substance known as *parillin*. We import about 150 tons annually. There are three preparations of this drug in the Pharmacopœia. The compound decoction of sarsaparilla was at one time a very favourite remedy in cases of syphilis and rheumatism, but it is not now often used.

Sarsen-stone. [SANDSTONE.]

Sartes (Turki, *Sart* = "trader"), a term of wide application, but of no ethnical value, in Central Asia, being applied to peoples of Aryan and Mongol stock indifferently, and simply meaning, in the first instance artisans, townsfolk, traders, peasants, and then the settled populations generally, as opposed to the nomad element. The Iranian Tajiks, being always settled, were the first to be known as Sartes, hence the erroneous impression that the word had a racial meaning, implying an Iranian, in contradistinction to a "Turanian" people. There are Usbeg and other Tatar Sartes as well as Iranian Sartes in Bokhara, Khiva, and throughout Turkestan generally; but the vague use of the word and ignorance of its true meaning has caused great confusion in ethnological works treating of these regions.

Sarto, ANDREA DEL (ANDREA VANNUCCHI), so called because his father was a tailor, was born in Florence about 1487. In 1509 the Servite brothers employed him to paint the three frescoes in the porch of the Annunziata, and were so pleased with the result that they ordered four others. Francis I. invited him to Paris 1518, paid him well, and sent him home with money to buy for him examples of Italian art, but Andrea is said to have appropriated the amount. After his return he produced the figures of *Faith* and *Charity* in the Scalzo, the *Dance of Herodias' Daughter*, *The Beheading of John the Baptist*, *The Visitation*, and *The Birth of the Baptist* in the same cloister. His final achievement, *The Last Supper*, at S. Salvi, was finished in 1527, and he died in 1531.

Saskatchewan, name of a river in Canada, which rises in the eastern spurs of the Rocky Mountains, and flows through the provinces of

Assiniboia and Saskatchewan into Lake Winnipeg, passing the town of Saskatchewan.

Sassafras (*Sassafras officinale*), a North American tree belonging to the Laurel tribe, the essential oil contained in the root, wood, and bark of which is aromatic, stimulant, and sudorific. It is used in the United States in rheumatism and skin-disease, but chiefly by perfumers and soap-makers, and to scent tobacco and flavour various drinks. The wood and bark yield a yellow dye; the tree is often grown in England for ornament.

Sassanidæ. [PERSIA (*History*).]

Sassari, a province and its capital in the N. of the island of Sardinia, Italy. The area of the former is 4,137 square miles, but it is more rugged and far less populous than the S. province. The town of Sassari is situated in the N.W. angle, not far from Porto Torres, with which it is connected by railway. It occupies an elevation some 650 feet above sea-level, and was until recently surrounded by a wall and towers, built in the 14th century, which is the date also of the castle.

Satan. [DEMONOLOGY.]

Satellites are small celestial bodies attendant on the planets. They rotate round the planet, which is often called the primary, and which controls their motion. The inferior planets, Mercury and Venus, are unaccompanied by any satellites, while the Earth's attendant, the Moon, is naturally by far the best known of all. [MOON.] Venus was formerly believed to possess a satellite, first pointed out by Fontana in 1645, and many astronomers in the 16th and 17th centuries testified to its existence. Later work has, however, proved that some of the astronomers mistook certain stars for the satellite, while the others must be considered as the victims of illusion, since Venus has no obvious moon. Since the Middle Ages Mars has been credited with two satellites, which, however, do not appear to have been actually seen till 1877, since when they have been repeatedly observed. They are called Deimos and Phobos, and their diameters have been estimated as 6 and 7 miles; they are therefore the smallest known satellites. Jupiter has five satellites, four of which were discovered by Galileo, while the fifth was first noted in September, 1892, by Professor Bernard at the Lick Observatory. All lie very nearly in the plane of Jupiter's equator. The first four are visible even with the feeblest telescope, but the fifth is so small, being only about 100 miles across, and moves so rapidly, that it is nearly always invisible, for it fades away in the presence of the slightest amount of light from Jupiter. All Jupiter's satellites revolve more rapidly than does our Moon, the last discovered taking rather less than 12 hours, only 2 hours longer than Jupiter's own period of rotation. Between the first three satellites there are curious relationships. The mean motion of the first, together with twice that of the third, is equal to three times that of the second, and also the mean longitude of the first, together with twice that of the third, is equal to three times that of the

second, increased by 180° ; hence they cannot be all three eclipsed at one time, although each is eclipsed at every revolution. The times of the eclipses of these satellites have been recorded over a very long period, and their recurrences predicted. Careful observation led to the discovery that a certain definite difference was obtained between the observed time of an eclipse and the predicted time; the eclipse occurred before it was expected when Jupiter was nearest to the Earth, whereas it happened later when Jupiter was farthest away. This led to the idea that light took a definite time to travel, and, since the distance of Jupiter from the Earth in the two cases was known, this gave a means for measuring the velocity of light. The satellites are not only rendered invisible to us because they pass into the dark shadow of Jupiter cast by the sun, but they may actually pass behind the planet himself, in which case they are occulted. The moments when an occultation begins or ends are not nearly so sharply defined as the time of an eclipse, since it is difficult to see the satellite when it is at the very edge of Jupiter's disc. It is similarly difficult to see the satellite when it is pursuing a transit in front of the planet, but it generally casts a shadow, which is seen as a small dark moving spot on the planet's face. The detection of Saturn's satellites has extended over many years, from the discovery of the first by Huyghens in 1655, followed by the finding of four more by Cassini later in the same century and another two by Herschell, to the simultaneous observations made by Lassell at Liverpool and Bond in America on September 19th, 1848, of a small moon far away from the planet. Huyghens' satellite is the largest one known, its diameter being about 3,300 miles. The four moons of Uranus have their orbits in the same plane, and this plane is nearly perpendicular to the plane of the planet's orbit. This fact is curious and unique, while it is also remarkable that the orbits of the satellites appear to be perfectly spherical. These bodies are not bright objects, and are therefore difficult to detect. Neptune, like the Earth, possesses only one satellite, which revolves round its master in about six days.

Satin, a soft and closely-woven kind of silk to which a brilliant gloss is imparted by making the warp appear above the weft. It is manufactured largely at Lyons, Florence, and Genoa, and India and China produce plain, damasked, or embroidered satins, which are less bright than those of Lyons, but retain their brilliancy longer.

Satin-Bird (*Ptilonorhynchus holosericeus*).
[BOWER-BIRD.]

Satinwood, a handsome light-coloured hard wood with satin-like lustre, generally with a curled mottling of the grain. It is used in veneering and inlaying, and especially for the backs of hair-brushes. In the last century it was frequently employed in furniture ornamented with paintings. That from the East Indies is the product of *Chloroxylon Swietenia*, an ebenaceous tree, and is imported in round logs: the better quality, from Nassau in the Bahamas, in square logs, is the

product of another tree of the same order, probably *Maba guianensis*.

Satire is a pungent ridicule much employed by poets and prose-writers to lash the follies and vices of the age or society in which they live. The Greeks did not make much use of satire proper, but it flourished among the Romans, and was used with effect by its inventor Lucilius and the later poets Horace, Juvenal, Persius, and others. Among English satirical writers may be mentioned Pope and Swift.

Satrap, the governor of a province in ancient Persia. In power he was well-nigh absolute, and in the general decay that befell the country after the time of Cyrus many of the satraps transformed themselves into independent kings.

Saturn, in Roman mythology one of the most ancient of the gods, and associated in primitive times with agriculture (*serere*, *satus*, "to sow"), his wife being Ops, whose name signifies "plenty." The Saturnalia, the greatest festival of the year, answered roughly to our Christmas, and the most archaic metre in use among Italians was called Saturnian. He was usually represented as an old man bearing a sickle; the substitution in later ages of a scythe and the addition of wings and an hour-glass was due to his confusion with the Greek Kronos, connected by an etymological error with *chronos*, "time." Kronos was the youngest son of Uranus and Gæa, the brother and husband of Rhea, and the father of Zeus. Owing to a prophecy that he would be deposed by one of his children, he devoured them all save this last, for whom Rhea substituted a stone. Zeus fulfilled destiny by thrusting his father and the Titans into Tartarus, and putting an end to the Golden Age.

Saturn was recognised as a planet by the ancients, and was the outside member of the solar system as known by them. So far from the sun is he that $29\frac{1}{2}$ years are spent by him in going once round his celestial path. His orbit is about $2\frac{1}{2}^\circ$ from the elliptic, and is an ellipse differing considerably from a circle, his greatest distance from the sun being about 921,000,000 and his least about 823,000,000 miles. His diameters at the equator and poles differ considerably, the protuberance at the equator giving him there a diameter of 74,000 miles, while at the poles it is only 68,000. His rotation about his own axis is very rapid, taking about $10\frac{1}{2}$ hours, a number slightly exceeding that of Jupiter, while the plane of his equator makes an angle of about 27° with the plane of his orbit. In size Saturn is the largest of the planets except Jupiter, being in fact 700 times larger than our earth, but his density is so small that he would be able to float on water far more easily than an iceberg. From this it follows that he cannot consist of solid or liquid matter, and in fact we can only view a mass of clouds intensely heated within, the whole being probably a planet in the early stage of development—younger even than Jupiter. The most remarkable characteristic of Saturn, which makes him an object of such interest in the sky, is his possession of a luminous ring. This was

originally discovered by Galileo, who first thought that the planet was merely attended by two other bodies, one on each side of it, these two objects gradually fading away till the planet appeared alone, but later on reappearing. Their true nature was afterwards explained by Huyghens, who showed that these changes could be accounted for by a thin opaque circular ring surrounding the planet's equator, though at some distance away, and accompanying the planet on his travels. The ring is only luminous on account of its reflection of the sun's light; hence will be invisible to us when, for instance, we are endeavouring to look at the ring from below while the sun is shining above. It also sometimes happens that the plane of the rings passes through the sun or through the centre of the earth, in which case only the thin edge of the rings can be seen at all; unless then a powerful telescope is being used, nothing will be visible. Cassini, in 1675, showed that the ring was divided into two parts, the inner being the wider, and later another faint division appeared to divide the outer part into two smaller rings. In 1850 another ring was discovered by Professor Bond in America and Mr. Dawes in England; this is quite different from the outer rings, being dark, and generally known as the *dusky ring* of Saturn. The outer ones, though far from solid, can receive a shadow of Saturn, and themselves cast one on his disc. The dusky ring can do nothing of the kind, and its filmy nature doubtless prevented its earlier discovery. That the rings must rotate about the planet is necessary for their existence, and Sir William Herschell demonstrated that they actually did so by observing the motion of tiny spots of light upon them. Clerk Maxwell demonstrated that the rings are not continuous masses of matter, but consist of countless myriads of tiny satellites, so close together that to us they appear as one body. From observations made over a considerable period, it seems that the inner edge of the bright ring is gradually approaching the planet, while the outer edge of all is getting farther away, thus increasing the breadth of the bright rings. The planet has 8 satellites [SATELLITES], which seldom pass behind or in front of the planet's disc, and therefore are not objects of great interest.

Satyr, a class of beings of Greek mythology, connected generally with the worship of Dionysus, and represented as the offspring of Hermes and the Naiads, and figuratively taken as illustrating the vital powers of Nature. They are first mentioned by Hesiod. In art they are divided into full-grown Satyrs, of whom Silenus may be taken as a typical example, and the little imp-like Satyrisci, a kind of rustic Cupids. They were much given to wine, and to sensual delights generally. At a later period they were confounded with the Fauns, and also served as a model for the modern vulgar conception of the Devil's personal appearance. Spenser has embodied them in his *Faërie Queene*.

Sauerkraut, a German delicacy thus prepared: White cabbage is shred, and placed in

layers in a cask with salt, juniper, cloves or caraway or other condiments. These layers are allowed to ferment under pressure, the resulting liquor is poured off, and salt water added till scum ceases to rise. The mixture is then kept in a cool place, and under pressure, till needed for consumption.

Saumarez, JAMES, BARON DE, Admiral (1757-1836), first distinguished himself in the attack on Charleston (1776), and was twice promoted for bravery. His capture of a French frigate (1782) brought him knighthood. He was second in command at the battle of the Nile, gained a great victory off Cadiz in 1801, and commanded the Baltic fleet in 1809. In 1831 he was made Vice-Admiral of England.

Saumur, a town in Maine-et-Loire, France, situated on the left bank of the Loire, 38 miles below Tours. It contains interesting churches, a castle (11th century), almshouses, quaint specimens of domestic architecture, and many Keltic and Roman antiquities. Here is established the chief cavalry school of France. Sparkling white wines are the most important local products, but linen, enamels, glass wares, and leather are also manufactured.

Sauria, a Cuvierian order, containing the lizards and crocodiles. Huxley emphasised the relationship of birds and reptiles by placing them in a group which he called Sauropsida.

Saurians, a general term applied to more or less lizard-like fossils, some of which are Amphibia, though the majority are reptiles, and some of which attained enormous dimensions. The Labyrinthodont *Archegosaurus* from the Carboniferous system, and the Mesozoic Ichthyosauria, Plesiosauria, Pterosauria, and Dinosauria, most of which are noticed separately, are among the chief types. [REPTILES.]

Sauropsida. [SAURIA.]

Saury, SAURY PIKE, any fish of the Physostomous genus *Scombresox*, with five species widely distributed in the open sea. As in the Garpikes, both jaws are prolonged into a kind of beak, and set with small teeth; behind the anal and the dorsal fins are a number of detached finlets. The Common Saury (*Scombresox saurus*) is about 18 inches long, dark above and silvery-white below. It is abundant on both sides of the Atlantic, and in Britain is often called the Skipper, from its habit of rushing along the surface of the water to escape from the porpoises, etc.

Saussure, HORACE BENEDICT DE, was born at Geneva in 1740. He took early to science, especially to botany, and at the age of twenty-two was appointed professor of philosophy in Geneva, resigning his chair to Pictet in 1786. He ascended Mont Blanc in 1787, and his work, *Voyages dans les Alpes*, served as a text-book for future investigators. His *Essai sur l'Hygrométrie* was one of the first attempts to apply scientific methods to atmospheric phenomena, and he bestowed much

attention on the geological formation of Switzerland. He died prematurely in 1799.

Savage, RICHARD, claimed to be the natural and neglected son of Lord Rivers and the Countess of Macclesfield, and was born in 1697. Recent investigations lead to the almost irresistible conclusion that this story has no foundation (*Notes and Queries*, 1858), and that it was invented by Savage for the purpose of levying blackmail on his alleged mother. Nothing certain is known of him until 1717, when he published *The Convocation*, an attack in verse on Bishop Hoadley. For some years as an actor and playwright he led a reckless, disorderly, and wretched existence, being in 1727 condemned to death for killing a man in a duel; he was pardoned, and shortly afterwards wrote *The Bastard*, a savage poetical onslaught on his mother, whose nephew, Lord Tyrconnel, gave him a pension. In a brief period of tranquillity he composed *The Wanderer*, his best performance, but soon quarrelled with his protector and again became an outcast. He supplied Pope with some materials for *The Dunciad*, and evidently produced a favourable impression on Johnson, who had but just come to London. By the efforts of his friends a small annuity was raised for him on condition that he lived in Wales. Thither he went in 1739, but soon tired of his exile, and started on his return to London, when death overtook him in 1743 at Bristol, where he had been imprisoned for debt.

Savannah, a seaport and city of Georgia, U.S.A., stands on the right bank of the Savannah river, 18 miles from its mouth. A very large trade is done in the harbour—cotton, rice, timber, resin, and turpentine being the chief exports, whilst manufactured goods are imported in great quantities. Savannah was captured by Sherman in 1864.

Savannah Blackbird (*Crotophaga ani*), a bird allied to the Cuckoo, from Southern and Central America. The total length is about 14 inches, plumage bluish-black, glossed with violet. This bird, like other species of the genus, feeds on insects parasitic on cattle. They are said to nest in common, and to rear their young together.

Savary, ANNE JEAN MARIE RENÉ, DUC DE ROVIGO, was born at Marcq, Ardennes, in 1774, joined the French cavalry in 1790, and at the age of three-and-twenty became a major. He next served under Desaix in Egypt and at Marengo. Napoleon entrusted to him the slaughter of the Duc d'Enghien, and employed him in his negotiations with the Tsar. In the Jena campaign of 1806 he showed great military ability, and his diplomatic success at Madrid in 1807 was no less marked. After Napoleon's fall he wished to accompany him to St. Helena, but was imprisoned and condemned to death. He escaped and wandered for some years, reaching England in 1819. Making peace at last with the Bourbons, he was restored to his rank, and in 1831 commanded the army in Algeria, performing his task with credit. He died in 1833.

Savigny, FRIEDRICH CARL VON, born at Frankfort-on-Maine in 1779, was educated for the law at Marburg and Göttingen. In 1803 he brought out his *Treatise on the Right of Possession*. After a brief sojourn as professor at Landshut he was called in 1810 to the chair of Roman Law in the newly-established university of Berlin, and was also employed practically in the administration of justice, in 1842 attaining the position of Grosskanzler. Among his great works are *A History of Roman Law in the Middle Ages*, *The Modern System of Roman Law*, *A Treatise on Obligations*, and several volumes of miscellaneous essays. He died at Berlin in 1861.

Savin (*Juniperus Sabina*), a native of Southern Europe, the young green shoots of which yield an oil resembling turpentine. The preparations of this drug are sometimes employed to produce counter-irritation, and in the treatment of diseases of the pelvic organs.

Savings Banks, which were intended to do for the poor what ordinary banks do for the rich, were proposed by Defoe in the 17th century; but, though France and other European countries adopted them in the middle of the 18th century, it was left for a Buckinghamshire clergyman to initiate the movement in England in 1799. This example was followed in Scotland by a clergyman in 1807. The original savings-banks were voluntary, and have been dealt with by different Acts of Parliament, which have been consolidated and deal chiefly with the points of attendance of trustees, the comparison of pass-books with the bank-books, and the establishment of a good system of audit. Savings-banks have been in a great degree superseded by the establishment of Post-Office Savings Banks, first suggested by the Archdeacon of Northumberland in 1852, this suggestion having been carried into effect in 1861. The Post-Office system of banking has been adopted in India, the Colonies, and many European countries.

Savona (classical *Savo*), a city and port in the province of Genoa, Italy, is situated on the Riviera, 25 miles W. of Genoa, and, having a good modern harbour, does an increasing trade. Coal is imported extensively, the exports being chiefly fruits and local produce. Earthenware is the principal industry, but there are large ironworks, and ship-building employs many hands. Among the public buildings may be noticed the commanding castle of St. George, the late Renaissance cathedral, the Della Rovere palace, and the Cappella Sistina.

Savonarola, GIROLAMO, was born at Ferrara in 1452, and in 1474 entered a Dominican monastery at Bologna, where his fervent zeal won him profound respect. In 1482 he was sent to Florence, then under the brilliant but licentious sway of Lorenzo the Magnificent. His preaching at first attracted little notice, but at Brescia in 1486 his eloquent denunciations of prevailing vice and threats of wrath to come struck terror into his hearers. In 1490 he returned to Florence, and his first terrible sermon in St. Mark's gave him such a

hold over the population that Lorenzo began to feel uneasy. Savonarola rejected his overtures with scorn, predicting his speedy death and also that of the Pope and the King of Naples. As regards the first two his prophecies were fulfilled next year, and in 1494 Charles VIII. of France entered Florence, and swept away the Medicean dynasty. For three years the Dominican prior was virtually dictator, and a strange puritanic reaction came over the city of pleasure; but Alexander Borgia, the new Pope, combined with the Franciscans and the Arrabbiati and Medicean parties to overthrow the reformer, and the Piagnoni faction, which supported Savonarola, lost their supremacy. After endless intrigues Savonarola was ejected from his church, imprisoned with two of his faithful companions, Fra Domenico and Fra Silvestro, and finally executed in 1498. He left many writings, but *The Triumph of the Cross* is the only work of high importance.

Savory, two species of the labiate genus *Satureja*, *S. hortensis* (summer savory), and *S. montana* (winter savory), both natives of Southern Europe, grown from ancient times as sweet herbs, and introduced into England in 1562. Virgil recommends them for planting near bee-hives, and they were used in vinegar as mint-sauce is with us. The former is annual, the latter evergreen and shrubby.

Savoy, or SAVOIE, a district in the S. of France, bounded N. by the Lake and Canton of Geneva, E. by the Valais, S.E. by Piedmont, S. by the Hautes-Alpes and Isère, W. by the Rhône. Forming in Roman times the provinces of the Graian and Pennine Alps, this tract of country acquired in the 4th century A.D. the name of Sapaudia, whence its present designation. Conquered by Charlemagne, it passed to the Emperor Conrad, who gave it as a county to Humbert the Whitehanded, founder of the House of Savoy. It was erected with Piedmont into a duchy in 1416 under Amadeus VIII., whose dominions extended to Nice on the sea and to the Sesia in Italy. In 1720 Victor Amadeus II., obtaining the throne of Sicily, exchanged it for that of Sardinia, and thus became the first king. His successors headed the Italians in their resistance to Napoleon, and in 1848 Charles Albert took up the cause of the nation against Austria, was defeated at Custozza and Novara, and resigned in favour of his son Victor Emmanuel II., under whom Italy was united, but at the cost of Savoy, which was paid to France as the price of her aid in 1860, remaining, however, exempt from French taxation.

Sawdust is composed of the small particles of matter which are produced in the act of sawing, but the word is used in a narrower sense generally to denote the dust produced by sawing wood. This dust is used in many industries, as, for example, for the manufacture of oxalic acid, for polishing by jewellers, for the making of bois-durci, for packing by furriers and perfumers; and the coarser kind, such as comes from the old-fashioned handsaw, is of great use for packing ice.

Sawfish, any fish of the genus *Pristis*, with five species from tropical and sub-tropical seas. They belong to the same group as the Rays, and have the snout produced into a flat blade-like form (sometimes six feet long and a foot broad at the base), and armed at the side with projecting teeth. The true teeth are small; but with its "saw" the fish tears off flesh from its prey (often large cetaceans), or rips open the abdomen and devours the soft parts. The skin is used for polishing.

Saxe, MARSHAL, COUNT MAURICE OF SAXONY, natural son of Frederick Augustus I. of Saxony and Poland by the Countess von Königsmarck, was born in 1696. In 1717 he raised the siege of Belgrade. Going to France after the Peace of Utrecht, he accepted in 1725 the duchy of Courland. In spite of a valiant struggle he had to resign his acquisition and return to Paris. In 1734, his father being dead, he entered the French service under Berwick, and covered himself with glory at Philipsburg. Getting command of a division in the War of the Austrian Succession, he took Prague (1741) and Egra (1742), was made a Marshal, and entrusted with the charge of the army of Flanders. He won the battles of Fontenoy, Raucoux, and Laufeldt, took Brussels, Antwerp, Namur, Maestricht, and other fortresses, and was loaded with honours by Louis XV. He died in 1750.

Saxhorn, a brass wind-instrument, invented by a Mr. Sax at Paris about the year 1840. The instrument has a bell mouth turned upward and a cupped mouth-piece, and is fitted with valves for modifying the tones. The saxhorn exists in several voices, the tenor being that most in use. Though very little used for orchestral music, the saxhorn is generally employed in military bands.

Saxifrage (*Saxifraga*), a genus of calycifloral Dicotyledons, the type of the order Saxifragaceæ, comprising nearly 200 species, belonging to the temperate and arctic-alpine floras of the northern hemisphere. They are mostly dwarf perennial herbs, with tufted simple exstipulate leaves, and white, yellow, or pink flowers, with five petals, ten stamens, and two half-superior and half-united carpels. Of some twelve British species, *S. umbrosa*, London Pride, or St. Patrick's Cabbage, has fleshy leaves with notched margins, *S. granulata* bears numerous small tubers, *S. tridactylites* is viscid with glandular hairs and reddish trilobed leaves, and *S. hypnoides*, the mossy saxifrage, with much-divided foliage, forms tufts on our higher mountains. Many others are in cultivation, especially in our rock-gardens. One section (*Megasea*) has large fleshy leaves and large clusters of rose-pink flowers. The name refers to many of the species growing in crevices of bare rock, as if breaking it.

Saxo Grammaticus belonged to a warrior family of Denmark, and was born in Zealand about the latter half of the 12th century. He became secretary to Archbishop Absalon about 1180, and at his instigation began to compile a chronicle of Danish kings. This, the *Gesta Danorum*, was completed in 1208, and was held in high esteem during the Middle Ages.

Saxon Architecture is a variety of the Romanesque. From the fact of the Saxons employing chiefly wood for building purposes, not much of their architecture has come down to us; but Barnack, Bradford-on-Avon, and Earls Barton



SAXON ARCHITECTURE (ST. LAWRENCE, BRADFORD-ON-AVON).
(From a Photograph by Mr. R. Williamson, Trowbridge.)

churches afford us examples of it. It was rough and massive, characterised by alternate vertical and horizontal position of quoins, and sometimes ornamented on the outside by fillets. The windows were splayed both from within and without.

Saxony (Latin, *Saxonia*; German, *Sachsen*). The kingdom of Saxony has an area of 5,789 square miles, forming an irregular triangle with its base along the Erzgebirge range, which separates it from Bohemia, and its apex at Leipzig. Except in the south, where there are elevations of 4,000 feet, the surface is hilly, merging towards the north into the great central plateau of Europe. The soil is exceedingly fertile, yielding heavy crops of rye, oats, and other cereals, beetroot, potatoes, flax, and fruit. A small quantity of wine is produced. Coal is found in some abundance near Dresden and at Zwickau. Silver, silver-lead, tin, iron, cobalt, copper, zinc, and bismuth are profitably worked, and there is a good supply of building-stone, porcelain-clay, and brick-earth. Textile industries of cotton, wool, and flax flourish. Dresden and Meissen are the seats of large china and pottery works. The iron-smelting and machine-making at Freiberg and Chemnitz employ many hands, and Leipzig is the centre of the printing trade of Germany. Lace-making and straw-plaiting are carried on in the rural districts. The Elbe is the chief river and, with its affluents, drains the whole country, except the small portion which sends its waters through the Neisse into the Oder. Dresden is the capital. Saxony is represented in the Bundsrath by four members, and in the Reichstag by twenty-three. It was not till 1423 that Frederick, Margrave of Meissen and Landgrave of Thuringia, was recognised as Elector of Saxony, whose grandsons Ernest and Albert divided their territories, the former taking Thuringia as well as Wittenberg, whilst Meissen and East Saxony fell to Albert. The Albertine line ultimately secured most of the land and the Electoral dignity on the defeat of John Frederick, the last Ernestine

Elector, at Muhlberg by Charles V. (1547). At the Peace of Westphalia (1648) the Elector, John George, deserted his principles, and the prestige of the duchy declined, whilst portions were alienated in favour of younger sons. Frederick Augustus I. and his son added the kingdom of Poland to their ducal titles, but their reigns were disastrous to their subjects. Under Frederick Augustus (1763–1827) the duchy became a kingdom, but in 1815 more than half the territory was handed over to Prussia. A long struggle for constitutional liberty now ensued, marked by concessions in 1831 and reactionary measures after 1848. In 1866 Saxony aided Austria against Prussia, and was compelled to pay an indemnity, join the Northern Confederation, and abandon its independent political relations with other Powers. In 1870 Saxony fought on the side of Prussia against France under the leadership of the present king, and is now regarded as a loyal member of the Empire. The name is applied also to the Saxon Province of Prussia (q.v.).

Saxophone, another of the horns invented by Mr. Sax. It consists of a conical brass tube, having a single reed as mouthpiece, and fitted with finger-valves, modulating the tone by means of twenty holes. Like its relative, it is used much in military music, but not in the orchestra.

Say, JEAN BAPTISTE, born at Lyons in 1767 of Protestant parents, was educated in England for a business career, but returned to France as secretary to the finance minister, Clavière, who directed his mind to the study of political economy. During the Revolutionary period he was an active journalist and politician. In 1800 he published *Olbie*, an essay on reform, and in 1803 his *Treatise on Political Economy*. Under the Empire he devoted his energies to the cotton trade, but after the peace became professor, first at the Conservatoire des Arts et Métiers and later at the Collège de France. His *Letters to Malthus* and *Course of Political Economy* appeared in his later years. He died in 1832. His grandson, the well-known French politician, M. Léon Say, was born in 1826.

Sayers, TOM (1826–65), a famous pugilist, who attained immense popularity in his day. He was almost the last of the old school of prize-fighters.

Scab, the name applied to a parasitic disease in sheep.

Scabies. [ITCH.]

Scabious (*Scabiosa*), a considerable genus of perennial herbs belonging to the Teazle family (Dipsacæ), and named from their former use in skin disease. There are three British species, the blue-purple and lilac capitula of which, distinguished from all Compositæ by the four free anthers of each floret, are familiar on every heath and in every cornfield. The abruptly "premorse" rhizome gives one species (*S. succisa*) the popular name Devil's-bit, the legend being that the tip of the root was a cure for all diseases, and was therefore bitten off by the Evil One out of envy of the human race. A species (*S. atropurpurea*) common in

gardens, with dark chocolate-black flowers with white stamens, is known as "mournful widow."

Scad (*Caranx trachurus*), the Horse Mackerel (q.v.).

Scævola ("left-handed"), the surname given to Mucius Coelius Codrus, a Roman warrior who, when Porsena invaded Rome in 507 B.C., entered the Tuscan camp in order to kill the king. He was seized and dragged before his intended victim, whereupon he thrust his right hand, which had failed of its aim, into the altar fire, and held it there till it was consumed, telling the invader that three hundred comrades as resolute as himself had sworn to take his life. Porsena released him and made peace with Rome.

Scafell, or SCAW FELL, the highest mountain in England, stands at the head of Eskdale in Cumberland, close to the border of Westmoreland, and 11 miles south-west from Keswick. There are two peaks, Sca Fell Pike (3,210 feet), and Sca Fell (3,162 feet). Like the rest of the system, they are composed geologically of a granitic base capped by crystalline schists and quartzitic grits.

Scagliola denotes in ornamental art an Italian process for imitating stone. The material is composed of plaster and glue, receives bits of stucco or stone, according to the imitation desired, and may be coloured by metallic oxides. Granite can be imitated by employing small crystals. Sometimes as many as twenty coats are put on before the surface is finally polished.

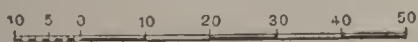
Scale in music denotes the gradation of sounds passed through between a note and its octave. In some parts of the world a pentatonic scale prevails—*e.g.* in Chinese and ancient Celtic music—while the tetrachord and hexachord have had their admirers; but the modern European scales are octave, and are divided into *diatonic*, of which there are 12 major and 12 minor, and *chromatic*, in which the subdivision is much more minute. Some races make shades of tone too minute to be distinguished by a European ear.

Scales, horny modifications of the skin in reptiles, on the legs of birds, and in some mammals. The scales of fishes are developed in grooves or pockets of the skin, as are the hair and feathers of higher animals. In the Sharks and Rays scales are replaced by "skin-teeth," consisting of a horny base covered with enamel.

Scales, MATHEMATICAL. It is obviously impossible to draw a map upon paper which shall be the same size as the country indicated, and the same holds with regard to architectural plans, etc.

It is therefore usual to settle upon a convenient size for the map, and then reduce

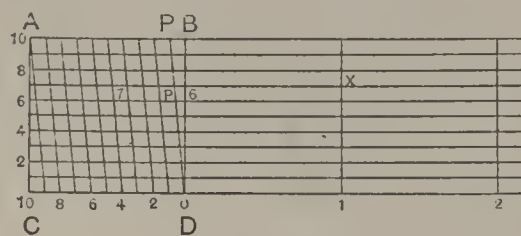
all the actual linear measurements in the same ratio, that ratio being so chosen that the whole can be fitted into the size of the map. The drawing is then said to be made to scale, and this is indicated by stating the "representative fraction" or ratio which the scale bears to the original, for example,



SCALE (Fig. 1).

1 : 63360, or by noting the equivalent fact that it is a scale of 1 inch to the mile. This scale would only need a foot-rule divided in the usual way into inches and convenient fractions, but a scale of, say, 1 inch to 25 miles could be constructed in the following way to show a distance of 50 miles. Since 25 miles is indicated by 1 inch, 50 miles will need 2 inches; draw, therefore, a line 2 inches long and divide it into 5 parts, the points of division being numbered from 0 to 50, and each division representing ten miles. One division is subdivided into 10 parts representing single miles, this may be either the first division (from 0 to 10), or another 10-mile division drawn on the left of zero as shown in the accompanying figure (Fig. 1).

A *diagonal* scale is an elegant method for obtaining small subdivisions. Suppose, for example, it



SCALE (Fig. 2).

were desired to measure to hundredths of an inch, the simple scale would show divisions to 10ths, and above this would be drawn 10 equidistant parallel horizontal lines, perpendicular lines crossing them at every inch. The line AB (Fig. 2) is divided into tenths similarly to CD, a line is drawn from D to a point $\frac{1}{10}$ inch from B, other lines parallel to this being drawn through each division on CD. The distance x 7, therefore, is equal to 1.37 inches, for $x 6 = 1$ inch, and $p 7 = .3$ inch, while $6 p : B P = c 6 : B C = 7 : 10 \therefore 6 p = .7 B P = .07$ inch. It is to this principle of proportionality that the scale owes its value. A comparative scale is one connecting two different kinds of measurements. For instance, 30 Greek stadia might be represented by 5 inches, and a comparative scale of English miles would be thus found: 20 English miles would be a convenient length to take. Take 1 stadion = 1,094 yards \therefore 30 stadia = 32,820 yards and 20 English miles = 35,200. Then, as 32,820 yards are represented by 5 inches, 35,200 will be shown by 5.36 inches, and this latter line can be divided in the usual way. So, by measuring with compasses any length on the first, we get a number of stadia, and transferring the compasses to the second gives the equivalent number of miles.

Scales of Notation. We are accustomed to express any number in terms of multiples of ten and its powers; for instance—

$$7234 = 4 + (3 \times 10) + (2 \times 10^2) + (7 \times 10^3).$$

Here 10 is said to be the *radix* of the scale, which is known as the decimal scale or system. The radix might, however, be any other number, *e.g.* the number 7234 might be expressed as 30042, the radix being 7; for

$$4 + 3 \times 10 + 2 \times 10^2 + 7 \times 10^3 = 2 + 4 \times 7 + 0 \times 7^2 + 0 \times 7^3 + 3 \times 7^4.$$

The use of the decimal system is very general, the

choice of ten as the radix being probably suggested by the number of fingers, but other systems have been in vogue. [NOTATION.] The duodecimal system (radix 12) leaves some signs of its existence in the foot (12 inches), the shilling (12 pence), etc.

Scaliger. 1. JULIUS CÆSAR SCALIGER, born at La Rocca, on the Lake of Garda, in 1484, became page to the Emperor Maximilian, and until 1514 followed with much distinction the profession of arms. He then entered the university of Bologna, and for some few years combined fighting with the study of medicine, until in 1525 illness compelled him to finally abandon the sword. He spent the remaining years of his life at Agen. He attacked Erasmus in a violent and overbearing style, wrote a Latin grammar, and began a treatise on Poetics, but his really important work was the exposition, in a series of commentaries, of the *Physies* and *Metaphysies* of Aristotle. Scarcely anything was published by him until just before his death, when his *Exercitationes* on Cardan's treatise *De Subtilitate* appeared, and for many years remained a popular text-book of Aristotelianism.

2. JOSEPH JUSTUS SCALIGER, tenth son of the foregoing, was born at Agen in 1540, and acquired, as his father's amanuensis, a sound knowledge of Latin and habits of observation. In 1558 he went to Paris, where he mastered Greek and made some progress in Hebrew and Arabic. Being a Protestant convert, he fled after the massacre of St. Bartholomew to Geneva, where he lectured for a while; but teaching was not to his taste, and, returning to Poitou, he spent twenty years in broken but fruitful study. His *Conjectanea in Varronem*, and his editions of Festus, Catullus, Propertius, and Tibullus marked a new era in historical criticism, and the *De Emendatione Temporum* (1583) established a new and sound system of chronology. His reputation now brought him an invitation from the university of Leyden, and in 1593 he succeeded to the chair of Lipsius on the understanding that he should not lecture. He died in 1609.

Scalp, the term applied to the tissues covering the bony cranial vault. Beneath the skin of the scalp there is a layer of subcutaneous fat, and below this lies the occipito-frontalis muscle with its aponeurosis; deeper still is a layer of connective tissue covering the pericranium. The skin of the scalp is very thick, and is intimately adherent to the underlying aponeurosis. Scalp injuries are said to be particularly apt to be followed by inflammatory troubles and by erysipelas. [For Baldness, see ALOPECIA.]

Scammony, a valuable purgative resin obtained from the milky latex in the long tap-root of *Convolvulus Scammonia*, a native of the Levant from Syria to the Crimea. The drug has been used since the 3rd century B.C., and is now chiefly collected in Asia Minor and near Aleppo, the best, which is unadulterated with earth and grey in colour, being shipped from Smyrna. It contains the resin *jalapin* or *scammonin* ($C_{31}H_{50}O_{16}$). This

drug and its preparations are employed in medicine for their purgative properties. The compound scammony pill and powder are administered in doses of from 5 to 12 grains, and the scammony mixture is employed in doses of half an ounce in children.

Scanderbeg (ISKANDER or ALEXANDER BEY), the name given to GEORGE CASTRIOTA, who was sent when a boy early in the 15th century as a hostage to Amurath II. and brought up in the Mohammedan creed. In 1443, being in command of a force against the Magyars, he conspired with John Hunyadi to free Albania, and, having got Croya, the capital, into his hands, he embraced Christianity and independence. In 1461 Mohammed II. was compelled to recognise him, but three years later he again plunged into war with Turkey, and died at Alessio in 1467.

Scape, an inflorescence rising direct from an underground stem. It may be one-flowered, as in the tulip and crocus, or many-flowered, as in the hyacinth or cowslip. The inflorescence of *Anemone* is termed a scape, and the three leaves below the flower are considered as bracts because there are other radical leaves, whilst the four leaves below the flower of Herb Paris are considered as foliage-leaves because there are no others. The term scape is not strictly applicable to such cases as this last and that of the lily-of-the-valley, where the branch from the underground stem bears one or two foliage-leaves below the inflorescence. Whilst the hyacinth is a *racemose* scape, the cowslip is an *umbellate* and the daisy a *capitulate* one.

Scapegoat, the goat on which the Jewish high-priest, on the Day of Atonement, laid the sins of the people, and then drove it into the wilderness. [AZAZEL.]

Scaphoid, the name applied to two bones of the human skeleton, one in the wrist and one in the foot.

Scaphopoda, a class of Mollusca (q.v.), the members of which have a univalve shell shaped like a tusk, and composed of white ivory-like material. The animal has a head, and thus belongs to the group Glossophora. The head is, however, somewhat imperfectly developed, is cylindrical in form, has the mouth at the anterior end, and is surrounded by a circle of tentacles. The class is further characterised by the absence in its members of a heart or gills. The shell is open at both ends. The animal lives in the sand along the coast. There are three living genera. *Dentalium entale*, the common Elephant-tooth Shell, is the best known species. The class dates from the Carboniferous.

Scapula, or SHOULDER-BLADE, the triangular-shaped bone which lies upon the upper and posterior part of the thorax, connected with the sternum through the mediation of the clavicle, and articulating with the humerus. From the upper part of the posterior surface of the scapula there projects a bony ridge, which is called the spine of the scapula; above this lies what is called the supraspinous fossa, and below it is the infra-spinous

fossa. From the external extremity of the spine two processes project, once called the coracoid process, and the other the acromion process. The clavicle articulates with the latter process. Several of the important muscles of the back and shoulder are attached to the scapula.

Scarabæus, a genus of beetles, belonging to the Scarabæidæ, of the Lamellicornia. There are about seventy species found in Africa and the



SCARABÆUS.

south of Europe and Asia. They live on dung, laying their eggs in balls which they roll up. The sacred beetle of Egypt (*S. sacer*) is found on the shores of the Mediterranean Sea.

Scarborough, a port and favourite watering-place in the

N. Riding of Yorkshire, standing on a cliff about 300 feet high between Flamborough Head to the S. and Whitby to the N. The old town to the landward is connected with the fashionable modern quarter by an iron bridge, and is dominated by the castle dating from the 12th century. There are saline and chalybeate springs. As the only safe harbour between Whitby and the Humber, the port of Scarborough commands a considerable share of the coasting trade and some foreign traffic, has three piers, a lighthouse, and a floating dock.

Scarlatti, ALESSANDRO, was born in 1659, and, after a musical training by Carissimi, became in succession *maestro di cappella* to Queen Christina of Sweden, the Viceroy of Naples, and Cardinal Ottoboni. He was a most prolific yet careful writer, a master of counterpoint, the inventor of recitative, and the founder of the Neapolitan school. He died in 1725. DOMENICO, his son, was born in 1683. His fame rests mainly on his skill as player both of the harpsichord and the organ. In 1715 he was entrusted with the musical arrangements at St. Peter's, Rome. He died in 1757.

Scarlet Fever, SCARLATINA, is an infectious malady characterised by a peculiar punctiform eruption attended by sore throat and febrile disturbance. The incubation period of the disease varies from about 24 hours to 6 or 8 days. The invasion is usually marked by shivering, headache, often vomiting, and soreness of throat. On the second day of the illness the rash appears, usually upon the chest first, but soon becoming generally diffused. The rash is "fully out" on the third or fourth day, and then begins to fade; when it has disappeared, the skin commences to desquamate, the cuticle separating in scaly flakes, which are most prominently developed on the palms of the hands and soles of the feet. The temperature is usually markedly raised on the first day of the

disease, and the patient remains in a feverish condition during the development of the rash; the pulse is much accelerated also during this period. In some instances the disease assumes quite a mild form, *scarlatina simplex*; in others the throat is markedly involved, *scarlatina anginosa*, and a condition of diphtheritic inflammation may be present. The severest form of scarlatina is the *malignant* variety, in which death sometimes occurs before the rash has had time to develop. There are several sequelæ of scarlet-fever, to which reference must be made. Conjunctivitis, otitis, and rhinitis may be present. There is sometimes rheumatic mischief, and inflammation of the serous membranes may occur. The most important sequela of the disease is albuminuria, associated with involvement of the kidneys. If these organs are seriously affected, there is marked dropsy, and a uræmic condition may supervene. Scarlet-fever usually affects young children, and second attacks of the disease are rare. It is generally produced by the transmission of the poison from some infected person or object. It is not uncommonly conveyed by infected milk. Treatment consists in isolation of the patient, who should be kept at rest in bed and fed upon light diet. Exposure to draughts should be avoided, and the possible supervention of complications carefully watched for, that appropriate treatment may be employed without delay. If the patient be not removed to the hospital, the most rigid precautions must be taken to guard against the spread of infection.

Scarlet-Runner (*Phaseolus multiflorus*). a native of Mexico, is a climbing bean now much cultivated in England, with a thick tuber, annual twining branches, and scarlet or white flowers on many-flowered peduncles, which are succeeded by rough pods. These are eaten when green. The ripe seeds are purple with black dots.

Scarlett, JAMES, BARON ABINGER, born in 1769, was called to the bar in 1791, and, taking silk in 1816, won a seat in Parliament as a Tory two years later, and became Attorney-General in 1827, retiring with Lord Goderich, but being recalled by Wellington in 1829 to support Catholic Emancipation. In 1834 Peel made him Chief Baron, and he died in 1844.

Scarron, PAUL, was born about 1610, and became an abbé. Visiting Italy, where he appears to have led a wild life, he returned to Paris in 1635. Soon after this, from fever or some other disease, he contracted a rheumatic affection which distorted his whole body and paralysed his lower limbs. He married in 1652 Françoise d'Aubigné, afterwards Mme. de Maintenon, and his house became the centre of literary society. Scarron died in 1660. His only work of merit is *Le Roman Comique*.

Scepticism (Greek, *skeptomai*, "I consider"), as a philosophical term, denotes the attitude of mind which subjects all belief or opinion, whether based on ecclesiastical dogma or "common sense," to the criticism of the human intellect. The term does not properly connote disbelief or even doubt, but,

as the ultimate basis of things is insoluble for human reason, the spirit of doubt may be regarded as its natural outcome. The Sceptics were a Greek school of philosophers founded by Pyrrho (q.v.). The Sophists (q.v.) held very similar views. David Hume (q.v.) is commonly regarded as the representative of modern Scepticism, the latest development of which is Agnosticism (q.v.).

Sceptre (Greek, *skēptron*, "staff"), originally a staff for the aged, but in the *Iliad* already the badge of military, judicial, or religious authority. Specimens of the sceptres used by Etruscan kings and priests, consisting of hollow gold truncheons adorned with beautiful designs, are preserved in the British Museum. In the days of the Roman republic an ivory sceptre was borne both by the consul and the victorious general (*imperator*). When the emperor had superseded both, the ivory staff was surmounted by a golden eagle, which, after the introduction of Christianity, was frequently replaced by a cross. Both these types were in use during the Middle Ages. A fine collection of old English sceptres was destroyed by the Puritans. Of the six sceptres now preserved in the Tower, four date from the reign of Charles II., one from that of James II., and one from the coronation of William and Mary.

Schadow (1), JOHANN GOTTFRIED, born at Berlin in 1764, became the favourite pupil of the sculptor Tassaert. Some two hundred of his works adorn the chief cities of Prussia. He wrote on art, and died in 1850. (2) RUDOLPH, his eldest son, born in 1786, followed his father's example, and was attaining some reputation when he died in Rome at the age of thirty-six. (3) GODENHAUS FRIEDRICH WILHELM was born in 1789. In 1819 he was made professor in the Berlin Academy, and in 1826 succeeded to the directorship of the Düsseldorf Academy, which under him achieved high distinction. He died in 1862.

Schaffhausen, a canton and its capital in the north of Switzerland. The former has an area of 109 square miles, and is surrounded by the duchy of Baden on all sides except the south, where Zürich forms the boundary. The surface is mountainous, but the valleys are very fertile, yielding cereals, wine, etc. The climate is mild and healthy. The town stands on the right bank of the Rhine about three miles from the picturesque falls, which attract many tourists. Several important industries are carried on—*e.g.* iron-founding, railway-carriage-building, and the manufacture of cotton and woollen goods, and of sparkling wines.

Schall, JOHANN ADAM VON, was born at Cologne in 1591, and, becoming a Jesuit, was selected to lead a mission into China. He met with a favourable reception from the reigning emperor, was created a mandarin, and allowed to erect churches and convert the natives. The next sovereign, however, sentenced Schall to death and threw him into prison, where he died in 1669.

Scheele, KARL WILHELM, born in 1742, showed an early taste for chemical study, and followed for

some years the business of apothecary at Stockholm, Upsala, and Köping. He discovered, among other valuable products, oxygen, chlorine, barytes, fluorine and tartaric acid, arsenite of copper (Scheele's green), glycerine, and prussic acid. His important work *Air and Fire* appeared in 1777, and most of his remarkable experiments were recorded in papers contributed to scientific periodicals. He died in 1786.

Scheffel, JOSEPH VICTOR, VON, was born in 1826, and educated for the law, which he soon abandoned for literature. His first venture was a collection of student songs entitled *Gaudeamus* (1853). This was followed by *The Trumpeter of Säckingen*, *Ekkehard*, *Frau Aventure*, *Juniperus*, *Bergpsalmen*, and *Der Brautwillkom*. In 1884 he published his last work, *Hugideo*, dying in 1886.

Scheffer, ARY, a French painter of Dutch extraction, was born in 1795, and exhibited at the age of twelve. He achieved considerable success as a *genre*-painter with such productions as *La Veure du Soldat* and *Le Retour du Conserit*. Later he produced his well-known illustrations of *Faust*, *Mignon*, *Francesca da Rimini*, *Dante and Beatrice*, and the *Giaour*, between 1827 and 1836. He was now drawn to religious subjects, and during the next ten years painted *Christus Consolator*, *Christus Remunerator*, *St. Augustine and Monica*, and other kindred works. He died in 1858.

Scheldt, or SCHELDE, THE, a river which rises near Catelet, Aisne, France, and flowing north for 75 miles, enters Belgium near Mortagne, and, after traversing Belgium to Antwerp, a distance of 137 miles, divides into two branches, the East and the West Scheldt, which pursue a further course of 37 miles through the Netherlands till they find their way by various estuaries into the German Ocean. It has upon its banks the towns of Cambray, Denain, Valenciennes, Fontenoy, Tournay, Oudenarde, Ghent, Dendermonde, and Antwerp, and is connected by canals with many other places, being navigable almost throughout its entire length.

Schelling, FRIEDRICH WILHELM JOSEPH VON, was born in 1775. He completed his education at Tübingen, where he began his friendship with Hegel. As early as 1793 he came under the influence of Kant's metaphysics as modified by Fichte, and wrote two treatises which commended him to the latter teacher, and in 1798 he was appointed professor of philosophy at Jena. He now developed views somewhat opposed to those of his patron, and these he embodied in the *Naturphilosophie* and the *Transcendental-Idealismus*. In 1803 he left Jena, having married, by amicable arrangement, the divorced wife of A. W. Schlegel, and, after a brief residence at Würzburg, was called by the King of Bavaria to a post in the Munich Academy, being ultimately promoted to a professorship in the New University (1827). In 1841, at the invitation of the King of Prussia, he went to Berlin as a supporter of orthodoxy. In later life his philosophy developed in the direction of mysticism. He died in 1854.

Schenkel, DANIEL, was born in 1813, and occupied the pulpit for a time at Schaffhausen, but resigned in 1849 to take up the theological professorship at Basle, whence two years later he passed to Heidelberg. His greatest work, *Das Charakterbild Jesu*, is somewhat rationalistic in tone. He died in 1885.

Scherer, EDMOND HENRI ADOLPH, was born in 1815, and educated partly in England. He obtained a professorship of exegesis at Geneva. Here he became closely allied with Vinet, and strongly advocated the divorce between Church and State. He edited *La Réformation au XIX^{me} Siècle*, and wrote much in the way of literary criticism. In 1860 he returned to Paris, joined the staff of the *Temps*, became correspondent of the *Daily News*, and gained a seat in the Chamber in 1871. He died in 1889.

Schiller, JOHANN CHRISTOPH FRIEDRICH VON, was born at Marbach in 1759. The reigning duke noticed the boy and adopted him, sending him to study first law and then medicine. Schiller, however, gave his best energies to the composition of *Die Räuber*, a play directed against the old order of things, and his patron cast him off. In 1783 he produced *Fiesco* and *Kabale und Liebe* at Mannheim. In 1790 he was appointed professor of history at Jena, and married Charlotte von Lengefeld. He now dropped poetry for a time, and began his unfinished *History of the Revolt of the Netherlands* and *History of the Thirty Years' War*. Later, however, he contributed to periodicals some of his best ballads and lyrics. In 1799 he transferred his home to Weimar, chiefly for the sake of Goethe's society, and set to work upon the great dramas of *Wallenstein's Camp*, *The Piccolomini*, and *Wallenstein's Death*, which were all put on the stage within a few months. *The Song of the Bell*, *Maria Stuart*, *The Maid of Orleans*, *The Bride of Messina*, occupied him during the next four years, and he was engaged on *Demetrius* when he died on May 9, 1805. Schiller was most successful as a writer of ballads and lyrics, upon which he brought to bear his exquisite sense of beauty in diction and rhythm.

Schists, crystalline rocks in alternating layers or *folia* of different minerals. On the Continent the term is often extended to slates and shale (q.v.), the constituents of which, though laminated or cleaved, are neither crystalline nor alternating. There seem sometimes to be transitions in the field, on the one hand, from shales, slates, and sandstones to spotted slates—*i.e.* slates with scattered crystals, quartzites, and true schists; and, on the other hand, between confusedly-crystalline rocks and those that are foliated; but these transitions, even if demonstrated, are not conclusive as to modes of origin. The distinction between schists and foliated rocks—*i.e.* between schistosity and foliation—is one of minor importance, dependent as it is mainly on the presence in the former case of a laminated mineral, such as mica or talc in masses of considerable surface. Thus gneiss often passes into mica-schist. The most abundant schists are the light-coloured and but slightly greasy *mica-*

schist, *talc-schist*, lighter and greasy to touch, often merely the result of the weathering of mica-schist, the dark-green and soft *chlorite-schist*, and the harder *hornblende-schist*; but gneiss, quartzite, hornblende-rock, and other rocks which commonly occur in association with these schists, especially in the series known as Archæan (q.v.), are often spoken of with them under the general term of "the Crystalline Schists." Of the two conflicting theories as to their origin, the alleged occurrence of fragments exhibiting the same structure as the main mass in conglomerates at the base of the Cambrian, as at Bangor, is a strong argument against their merely metamorphic origin; whilst it is difficult to explain the formation of gneiss or mica-schist, to say nothing of graphite and crystalline limestone, as precipitates direct from a heated primitive atmosphere. It is now generally admitted that gneiss and hornblende-schist may result from the alteration of granite and diorite, and quartzite is often obviously only a partially-fused sandstone.

Schizocarp, a dry, partly deliscent, syncarpous fruit, splitting in such a manner as not to disclose its seeds, dividing into bodies known as *mericarps*, *cocci*, or *nutlets*, each consisting of a carpel or of half a carpel, and each generally containing one seed. Though physiologically identical, schizocarps are structurally of two classes—*viz.* superior, or *regmas*, and inferior, or *cremocarps*. As types of the first we have the fruits of the Malvaceæ, Geranium, Tropæolum, and Euphorbiaceæ, which split into their constituent carpels, and those of the Labiatae and Boraginaceæ, in which two carpels give, owing to ingrowth of their midribs, four nutlets. The *samara* (q.v.) of the maples is merely a winged regma. As types of the cremocarp we have the bicarpellate fruits of the Umbelliferae, which, being inferior, are necessarily in part receptacular in origin, and which split into two mericarps.

Schizocœle, the name of that type of body-cavity which results from a splitting of the tissues of the animal, and has no connection with the body-cavity of the original embryo. [CÆLOME.]

Schizomycetes. [BACTERIA.]

Schizonemertea, an order of worms belonging to the class Nemertea (q.v.), and characterised by the possession of a pair of deep longitudinal fissures, one on each side of the head. The two principal genera are *Lineus* and *Cerebratulus*. They are all marine.

Schizophyta, a term suggested for the Proto-phyta, a subdivision of the Thallophyta (q.v.), comprising both algal or chlorophyll-containing forms (Schizophyceæ), and those without chlorophyll (Schizomycetes), in neither of which is there any sexual reproduction. Though some are multicellular filaments, most are minute unicellular plants, and fission is the sole method of multiplication. The algal forms are now, however, referred to the Cyanophyceæ as a division of the Algæ (q.v.), and the fungal ones to a division of Fungi (q.v.) under the name Schizomycetes.

Schizopoda, an order of Crustacea, comprising the family of *Mysidæ* or Opossum-shrimps. Their nearest allies are the Stomatopoda or Squills and the ordinary *Decapoda* or Crabs, Lobsters, etc. From the former group the Schizopods differ in the possession of a large "cephalothoracic shield" or plate covering the anterior end of the body. From the Crabs and Lobsters they differ in having the eight pairs of limbs on the thorax composed of two branches or rami. The members of the group are all marine. *Gamponyx* and some other Carboniferous genera may belong to this order, which is otherwise unknown as a fossil.

Schlagintweit-Sakünlünski, HERMANN VON, was born in 1826, and, having a passion for travel, explored the Alps in conjunction with his two brothers, ADOLF and ROBERT, between 1850 and 1853, and published reports which attracted scientific attention. In 1854 the three were commissioned by the East India Company to undertake a series of investigations in the East. Hermann and Robert crossed the Kuenlun range, but Adolf, going into Central Asia, was killed by the Emir of Kashgar. Returning to Europe, the survivors published a record of their journeys. Hermann died at Munich in 1882.

Schlegel, AUGUST WILHELM, was born in 1767, and graduated at Göttingen, going ultimately as professor to Jena, where his brother was also established. At Jena he composed his classical tragedy *Ion*, and began the fine translation of Shakespeare which was finished by Tieck. In 1802 he moved to Berlin, published the *Blümensträusse*, and, having divorced his wife, entered into the literary service of Madame de Staël, with whom he travelled through Europe, delivering his lectures on *Dramatic Literature* at Vienna. For two years he acted as secretary to Bernadotte, but returned to Madame de Staël in 1815, and remained with her till her death. His last years were spent in the study of Sanskrit at Bonn, where he died in 1845.

Schlegel, KARL WILHELM FRIEDRICH, brother of the foregoing, was born in 1772. He assisted Schleiermacher to translate Plato, wrote *The Greeks and the Romans*, and startled society with a novel, *Lucinde*. In 1802 he went to Paris, and produced his treatise *On the Language and Wisdom of the Indians*, a work that marks an epoch. He died in 1829.

Schleicher, AUGUST, born in 1821, became professor of Slavonic philology at Prague in 1850, and in 1857 was appointed honorary professor at Jena, where he died in 1868. Among his best-known works are a *Compendium of the Comparative Grammar of the Indo-Germanic Languages*, a *Handbook of Lithuanian Languages*, and *The Languages of Europe*.

Schleiermacher, FRIEDRICH ERNST DANIEL, was born in 1768. He spent some years as a tutor and as a preacher in Berlin, working out meanwhile a religious and philosophical system of his own, which he revealed first in his *Reden über die Religion* (1799) and *Monologue* (1803). Meanwhile he was engaged upon his famous translation

of Plato. In 1804 he was appointed theological professor at Halle, returning to Berlin in the same capacity in 1810. He died in 1834.

Schleswig, or SLESWICK, a district and a town in the province of Schleswig-Holstein, Prussia, bounded on the north by Denmark and on the south by Holstein, and forming the neck of the Danish peninsula. It has an area of 3,000 square miles, and is for the most part undulating and fertile, with marshes along the deeply-indented coasts, which are only preserved from the sea by dykes. The rearing of cattle for export, the making of butter and cheese, and the sea-fisheries form the principal industries. Flensburg, Schleswig, Hadersleben, Husum, Tonder, and Frederikstadt do a considerable trade. The port of Schleswig is on the Schlei Creek, 70 miles north-west of Hamburg. Formerly a member of the Hanseatic League, it is the oldest town in the province, and contains the palace of Gottorp with its spacious grounds, the home of the ducal family that has supplied kings to Sweden and czars to Russia. [HOLSTEIN.]

Schliemann, HEINRICH, was born in 1822. Having inherited a fortune, he began in 1870 to carry out a long-cherished idea of exploring the sites memorable in Greek history. Beginning with Hissarlik, in the Troad, he extended his labours to Mycenæ, Orchomenus, Tiryns, and Ithaca. The remarkable antiquities, so far as they could be removed, have been acquired by the British Museum and the Museum of Berlin. The Turkish Government, however, resented this alleged spoliation, and Schliemann was fined £2,000. He did not live to complete his undertakings, dying at Naples in 1890.

Schmitz, LEONHARD, was born in 1807. In 1837 he migrated to London, where he collaborated with Dr. William Smith in the translation of Niebuhr's works, contributed to the well-known classical dictionaries, and in 1846 was appointed rector of the High School, Edinburgh, where he remained until 1865, when he became head of the International College, Isleworth. He died in 1890.

Schnitzer, EDUARD (EMIN PASHA), was born in 1840, and, after studying medicine, went to Turkey, where he adopted an Eastern name and habits, embracing, it is believed, the Mussulman faith. In 1876 he entered the Egyptian medical service, was sent to Khartoum, and appointed by Gordon chief medical officer in the Equatorial Province (1878). Soon after the outbreak of the Mahdists he was completely cut off from civilisation, and nothing was heard of him until his discovery by Stanley in 1889. Stanley brought him to Zanzibar, and he returned to Lake Victoria. At the end of 1893 rumours reached the coast of his murder by Arabs, but the facts are still uncertain.

Schnorr von Karolsfeld, JULIUS, was born in 1794, and entered the Academy of Vienna at the age of seventeen. He acquired skill as a fresco-painter, and in 1825 was engaged by King Ludwig of Bavaria to adorn his new palace with illustrations of early German history. Later on he brought out his *Bible Pictures* and *Pictorial Bible*. He died in 1872.

Scholasticism, the philosophy of the Middle Ages, grew out of the endeavour to reconcile man's innate tendency to speculation with the demands made upon his faith by the Church. John Scotus Erigena (q.v.) may be regarded as in some respects a forerunner of the schoolmen; but he cannot properly be reckoned among them, as his works have only an indirect bearing on the problems with which they were chiefly occupied. The great discussion which throughout the Middle Ages divided the schoolmen into two hostile camps was that concerning the real existence of the entities corresponding to abstract names. The Realists held that all *genera* and *species* exist as intelligible forms apart from their manifestation in this or that individual, whereas the Nominalists believed the sole source of general notions to be abstraction from particulars. The dispute was in great measure due to a confusion between names and things, which could not have persisted so long if men's minds had not been cramped by the exclusive study of the Aristotelian logic, whilst at the same time the authority of the Church prevented them from taking a free view of the universe and their own natures. The Renaissance and the Reformation were at once the symptoms and the causes of a new order of convictions; men now felt that the capabilities of the mind transcended the limits imposed upon it by tradition. They were seized with an eager desire to probe the secrets of Nature, and, wherever these ideas prevailed, the whole fabric of Scholasticism speedily crumbled away. Roscellinus (b. *circa* 1050) is held to be the founder of Nominalism, whilst Anselm (1033-1109) was the first who came forward to defend the Realism implicitly involved in the doctrines of the Church. Abelard (q.v.), the disciple of Roscellinus, carried his speculations much further than his master, thereby earning for himself many bitter years of persecution. The attempt to reconcile the discrepancies between the Fathers, which had been too clearly pointed out by Anselm, was undertaken with but imperfect success by his pupil Peter Lombard (q.v.). Early in the 13th century the metaphysical and ethical writings of Aristotle became known to the western world through the Arabian philosophers Avicenna and Averrhoes, and from that time the discussions of the schoolmen were carried forward on a wider basis. Albertus Magnus (q.v.) was the first who undertook the perilous task of reconciling the teaching of Aristotle with the doctrines of the Church. He was followed by Thomas Aquinas (q.v.), author of the famous *Summa Theologica*, in which he endeavoured to show that faith and reason may be regarded as independent sources of knowledge in their respective spheres. He was opposed by Duns Scotus (q.v.), who holds the same place among the Franciscan doctors which belongs to Aquinas among the Dominicans. The dispute between the two gave rise to the rival schools of Thomists and Scotists. Roger Bacon (1214-94) belonged to the Franciscan order, but he was far in advance of his age, and seems to have actually made use of inductive methods. The last of the great schoolmen was William of Ockham (*circa* 1270-1349), a pupil of

Duns Scotus, who carried Nominalism to its logical result, and thus undermined the whole scholastic system.

Schomburgk, SIR ROBERT HERMANN (1804-65), explorer, was born at Freiberg, in Prussia, and in 1826 went to the United States, where he was rather unfortunate. He joined an exploration then on foot, and, as his scientific knowledge was extensive and his repute good, the English Government sent him to British Guiana, then unknown. He brought back with him a magnificent collection of natural history, including the most beautiful water-lilies ever discovered and many fine orchids. He went again in 1840, and in 1845 was knighted. He wrote some important works on British Guiana, and was consul-general in Siam and elsewhere during his later years.

Schools, BROTHERS OF CHRISTIAN, a congregation in the Roman Catholic Church, composed of lay-brothers who devote their lives to the instruction of the poor, after receiving a preliminary training in the normal schools of the order. The society was set on foot by the Abbé de la Salle, who in 1684 resigned his canonry at Rheims in order to give himself wholly to this work. The schools are now doing a good work both in France, Italy, the south of Germany, and other parts of Europe, and in North America and Africa. The INSTITUTE OF IRISH CHRISTIAN BROTHERS, founded by a Waterford merchant named Rice in 1802, and recognised by the Pope in 1820, is now in a very thriving condition. The number of pupils attending the primary and other schools of the order is at least 40,000. The methods of teaching have been highly commended by various royal commissions.

Schooner, a small but swift vessel, of sharp build, which commonly has two masts, but sometimes three, and even four or five. A fore-and-aft schooner has fore- and aft-sails only, whereas a topsail schooner carries a square topsail and topgallant-sail. The latter rig is now seldom seen but in trading-vessels.

Schopenhauer, ARTHUR (1788-1860), German pessimistic philosopher, was the son of a banker, and was born at Dantzic. His mother, a well-known authoress, was acquainted with most of the great German writers of the time, who visited her house, and in that way the future philosopher had early and unusual opportunities of cultivating his intellect. His precocity was the subject of remark, and his peculiar contempt for humanity seems to have been developed in him whilst he was a boy. In 1809 he entered Göttingen University, afterwards attending the lectures of Fichte in Berlin, and travelling in England and France. He became very fond of English and French literature, and expressed some scorn for that of Germany and for his countrymen. In 1813 he had graduated at Jena, and, after much restless journeying, settled in Frankfort-on-the-Main, possessing sufficient means to gratify his whims. He pursued his studies closely, and lived the life of a recluse. He had a strong feeling of admiration for Oriental ideas, and enthusiastically praised Buddha. His principal work is that entitled *Die Welt als Wille und*

Vorstellung (*The World as Will and Idea*), which came out in 1819, and was very coldly received, a fact which did not tend to dissipate his contemptuous views of human nature. He was very ill-tempered, and had a profound disbelief in the goodness or intelligence of women. Slowly but surely he attracted some admirers of his philosophy, and a second edition of his work appeared in 1844. His philosophy is partly based on that of Kant; but the Will (= force), rather than the Idea, was the mainspring of his system. He held that human nature was as evil as it well could be. His style is excellent, and an English translation of his chief work appeared in 1886.

Schreiner, OLIVE, a young and gifted South African writer, who made a great reputation by her *Story of an African Farm* (1883).

Schubart, CHRISTIAN FRIEDRICH (1739-91). German poet and musician, was the author of various volumes of verse and writings on music. He was a tutor and organist, and led a discreditable life, receiving ten years' imprisonment in 1777 for uttering false news in a journal conducted by him. His poems are frequently good, and he was a bold and eloquent writer. His poems were collected and published in 2 vols. in 1802, and his complete works in 8 vols., 1839-40.

Schubart von Kleefeld, JOHANN CHRISTIAN (1734-87), German agriculturist, was an original thinker and innovator, whose ideas were not properly appreciated in his lifetime, though he enjoyed much popularity. He published in 1786 six volumes of treatises in *Rural and Public Economy*, which contain some very important suggestions and truths. During the Seven Years' War he was a war commissary, and previously held a position in the household of the ambassadors of Saxony at Vienna.

Schubert, FRANZ PETER (1797-1828), one of the greatest of musicians, was born in Vienna of a musical family, and at the age of seven became a pupil of one Michael Holzer. His family did not desire him to become a professional musician, having the idea that he would do better in some other walk of life. His remarkable genius was so soon manifested that he composed some beautiful pieces while almost an infant, and his excellent voice procured him admission to the choir of the Imperial Chapel. His father was a humble school-master, and gave him a fairly good education, and, to his disappointment, he was obliged to assist him in the tuition of the school, thus interrupting rather seriously his musical studies. He was enabled to take lessons from Salieri, and after a time began to teach pupils himself as a means of livelihood. He was at this time, as all through his later career, a most voluminous composer, attempting every branch of the art, and completing sonatas, operas, masses, overtures, symphonies, and cantatas. His first mass in E flat, which was found among the enormous quantity of MSS. he left behind him, is a magnificent work. He was a great admirer of Beethoven, and felt something like reverence for that master. Beethoven recognised his genius also, being one of the few who did so during Schubert's life. He was

much disappointed at the lack of appreciation of his earlier operas and other ambitious works, and died in Vienna, where he had mostly lived, of a fever. It is curious, seeing his notable feeling for Beethoven's music, that there is so little sign of the latter's influence in his works. He was a most strikingly original composer, and was perhaps at his best as a song-writer. His songs, which number about six hundred, are often perfect, and give the highest expression known to music of the sense of harmony and melody. It has often been regretted that his early masters did not more strictly supervise his budding genius, as otherwise there can be no doubt that he would have done work as memorable in other branches as in that of the lyric; but his teachers used to exclaim that his powers were so astonishing that they could not teach him anything. He set 67 of Goethe's and 54 of Schiller's songs to music. Schumann said of him that he could have set a placard to music, and Vogl described his glorious lyrics as "divine inspirations—utterances of a musical *clairvoyance*." Despite his marvellous gifts, Schubert had much difficulty in inducing the publishers to take his compositions, and when he died he left a tremendous mass of MSS. to his brother, which his friends and admirers proceeded to get published as speedily as possible, and even now that process of publication is going on. Schubert was buried near Beethoven in Vienna. Liszt has done a great deal to spread a knowledge of Schubert's genius, and was a passionate admirer of his works. Schubert wrote with great rapidity, 1815 being his most prolific year. His life has been often written. A complete list of his works is in Grove's *Dictionary of Music*.

Schulze-Delitzsch, HERMANN (1808-83). economist and politician, was born at Delitzsch in Saxony, and studied law, eventually obtaining some profitable legal appointments. He made various investigations into the science of economics, and, after his election as deputy to the Berlin Assembly, was made president of the commission to inquire into the condition of the working classes. He became, in 1861, deputy for Berlin in the North German Parliament and the Reichstag, and exercised much influence over many of the German workmen. He was a strong opponent of Lassalle's socialistic theories, being a confirmed individualist, and always advocated thrift and co-operation. His most valuable works are his *Das Associationsbuch* (1862) and *Die Arbeiterklassen* (1863), but in 1867 he issued a useful work on people's banks.

Schumann, ROBERT ALEXANDER (1810-56), musician, was born in Saxony, and in 1829 entered Leipzig University. Intended for the law, but with a strong predilection for musical studies, he finally gave himself up to his favourite art, and began to practise the pianoforte under Wieck and Dorn, composing a little and editing after a year or two a musical journal, which had a long and successful career. His leading compositions of this period are his *Études Symphoniques*, *Kreisleriana*, and other pieces less known. In 1840 he married Clara, the daughter of his teacher Wieck, and she did much to extend his fame by her performance of his works.

The same year saw his admission to the degree of doctor of philosophy at Jena University, and he then turned his attention to lyrical pieces, in which probably only Beethoven and Schubert surpassed him. He set most of Heine's songs to music. He commenced to write for the orchestra, and brought out some very beautiful symphonies and other chamber-music, as well as an opera *Geneviève* (1848), and a cantata entitled *Paradise and the Peri*, besides some overtures. He had been for many years suffering from mental disease, and on one occasion, whilst a young man, attempted to commit suicide. In 1854 he again tried to kill himself, and two years later died in a private asylum. At first he was somewhat derided, but later opinion has placed him on one of the highest pinnacles of modern musical genius. His compositions are often most entrancing, and there is no question now of his place in musical history. His works are becoming more and more popular in England as people are given more opportunities of judging. His life has been written several times by competent authorities. He was choir master at Düsseldorf towards the end of his career.

Schuyler, PHILIP JOHN (1733-1804), American soldier, was of Dutch descent and born at Albany, New York. Entering the army, he received a command in 1755, resigned it in 1757, and rejoined in 1758. Though he did not see much active service, his sagacity was most valuable to Washington, under whom he served. He became a member of Congress in 1778, and a senator in 1780.

Schwartzburg-Rudolstadt, a small Thuringian principality, with an area of 363 square miles, including a detached portion in Prussian Saxony. It lies about the rivers Schwarza, Gera, Ilm, and Saale, and is hilly, wooded, and picturesque, less than half being under cultivation. Cattle and fruit are the chief products, but iron, lignite, cobalt, and other minerals are worked on a small scale.

Schwartzburg-Sonderhausen, a similar and neighbouring principality, occupying an area of 333 square miles. It is somewhat more cultivated than the foregoing, though the mineral resources are less. From the 13th to the middle of the 16th century both of these territories were ruled over by a single Count of the illustrious house of Schwarzburg.

Schwarzenberg, KARL PHILIPP, PRINCE VON (1771-1820), Austrian general, was born of noble family in Vienna, and served in the Turkish War of 1789 and during the Wars of the French Revolution. He fought at Hohenlinden and Austerlitz, and showed great bravery at Wagram in 1809. He was rapidly promoted, and in 1812 was sent with a large army to the aid of Napoleon, and in 1813 became a field-marshal. He fought against Napoleon better than he had previously assisted him, and in 1815 was being sent to reinforce the English and Prussians when the news of Waterloo detained him. He was president of the Aulic Council during the last few years of his life.

Schweinfurth, GEORG AUGUST (b. 1836), African traveller, was born at Riga, and became a

doctor of philosophy at Berlin. He went to Africa in 1863, traversed the Nile valley as far as Khartoum, and made some botanical discoveries. On a second expedition he found the river Welle, a tributary of the Congo, and now called the Aruwimi. His valuable work, *In the Heart of Africa* (1871), records many interesting and important facts. He strongly opposed the extension of British influence in Africa. He was appointed director of the Natural History Museum at Cairo.

Schwenckfeld, GASPAR VON (1490-1561), reformer, was born in Silesia, and led a very troubled and wandering life for the most part. He first became a priest, but, agreeing with Luther as to main questions, he strongly objected to the latter's moderation and lack of enthusiasm. He was himself of excellent character, but a fanatic, and openly quarrelled with Luther in 1525, and was banished from Silesia. He made many disciples, and founded a sect of his own, which spread very widely. He thought the Scriptures were always, and would be always, wrongly interpreted. He was for a time an Anabaptist, but finally denied the inspiration of the Bible. His piety and sincerity were never questioned by any of his contemporaries except Melancthon.

Schwyz, a forest canton of Switzerland, extending for 350 square miles over a mountainous district between the lakes of Zürich and Lucerne, and including the peaks of Rigi and Böse Faulen (9,200 ft.). A great deal of the area is covered by lake, rock, or glacier, but there are good pastures and some arable land. Einsiedeln is the largest town, but Schwyz is the capital, and is about 16 miles from Lucerne. It contains a good modern church, Dominican and Capuchin convents, and does some trade on the lake.

Sciatica, pain in the course of the great sciatic nerve, which runs at the back of the thigh, and thence down the leg to the foot. The pain is neuralgic in character, and is aggravated by pressure, particularly when such pressure is applied in certain situations. The disease is sometimes brought on by exposure to cold, or may be associated with gout, malaria, and with rheumatic conditions. It is often very intractable, but sometimes yields to counter-irritation and the administration of appropriate remedies internally. In the more obstinate cases electricity is of service.

Scilly Isles (probably not the *Cassiterides* of the Greeks), a group of about forty islands off the coast of Cornwall, about 25 miles S.W. from the Land's End. Only St. Mary's (1,500 acres), Tresco (700 acres), St. Martin's (550 acres), St. Agnes (350 acres), and Bryher (300 acres), are inhabited. The formation is granitic, with a fertile top soil, which in the mild climate yields large quantities of early vegetables and flowers for the London market. Hugh Town, the capital, is in St. Mary's. Mr. Dorrien Smith owns all the group, and has a residence in Tresco.

Scintillation is the sparkling or twinkling effect noticeable in stars, and, since it is much more apparent when the star is on the horizon than

when it is near the zenith, the effect is attributed to the earth's atmosphere. It is commonly stated that this scintillation distinguishes stars from planets, but some of the planets have been observed to scintillate very slightly when near the horizon, though the phenomenon is not of frequent occurrence. All the stars are so far off that they have no sensible disc even when viewed through a powerful telescope; hence they may be considered as single points of light. The star will therefore send out very few rays of light to the eye compared to the number from the relatively larger planet, and so these few rays will exhibit the effect produced by a heterogeneous atmosphere, whereas the average effect on the greater number of planet rays will be constant. The planet will therefore give a steady light, whereas the star varies every moment.

Scioppius, CASPAR (1576-1649), German polemic, was a furious opponent of Protestantism and an adversary of Scaliger at one period. He was originally a Protestant himself, but became a Catholic, and wrote a panegyric of Clement VII. in 1598, for which he was rewarded. He visited Italy, Austria, and Spain, and rendered himself obnoxious everywhere by his ferocious onslaughts on Protestants, on James I., and afterwards on the Jesuits. His works were burnt by the common hangman in London and Paris. They show great learning, and some of the philological treatises are rather valuable, but his extremely partisan spirit destroys much of their merit. He died in Padua after a somewhat stormy career. His writings number over a hundred.

Sciopticon is a particular design of optical or magic lantern (q.v.).

Scipio, PUBLIUS CORNELIUS, "THE ELDER," surnamed AFRICANUS, was born of noble family in 234 B.C., and in youth was noted for his courage and decision. At the age of twenty-four he was proconsul in Spain, and commanded the forces which took Carthago Nova. His humane conduct was noticeable here as on many other occasions. He gradually made himself master of nearly all Spain, and was offered the sovereignty, but declined it. He formed an alliance with the king of Numidia, and in 206 returned to Rome, where he was welcomed, made a consul, and given Sicily as his province. In 204 he went to Africa, and gained many remarkable victories, capturing the Numidian king, who had deserted him, and concluded the second Punic War by the total defeat of Hannibal at Zama in 202. He was offered many honours in Rome, but refused most of them, becoming, however, censor and consul for a second time, and in 193 was ambassador to Syria. Accused and acquitted of embezzling money during the Syrian War of 190, he left Rome for ever, and died in 183. He was a great soldier, very prompt and energetic, and he was also deeply religious.

Scipio, PUBLIUS CORNELIUS ÆMILIANUS AFRICANUS, "THE YOUNGER," born L. Paullus Æmilius, and adopted by the last-named (185-129 B.C.), conqueror of Carthage, was partly instructed

by Polybius, and in 151 entered the military life by joining the expedition to Spain, and, after exhibiting his prowess there, proceeded to Africa to take part in the third Punic War. He became a consul in 148, and in the following year laid siege to Carthage and took it after the shedding of much blood. He was welcomed with acclamation on his return to Rome, and became censor in 142. He effected many reforms, and in 134 again became consul, Spain being his province. He captured Numantia after a stubborn fight, and greatly extended the Roman sway. His marriage with Sempronia, sister of the Gracchi, was unhappy. He lived a simple and, for that time, an extremely moral life, and was at last found dead in bed, being assassinated, it is believed, for political reasons.

Scirrhus. [CANCER.]

Scissortail (*Milvulus forficatus*), an American Flycatcher, with a long deeply-forked tail, which can be opened or closed like the blades of a pair of scissors.

Sclerostoma Duodenale, a nematode worm which sometimes infests the small intestine of inhabitants of Italy and Egypt.

Sclerotium, a densely-compacted tuberos form of mycelium which occurs in many groups of Fungi as a resting stage and store of reserve material. It consists of a central medullary tissue, often pseudoparenchymatous, enclosed by one or more layers of thick-walled cortical cells. The best-known example is that of the pyrenomycetous *Claviceps purpurea*, which is the ergot (q.v.) of grasses.

Scolopax. [SNIPE.]

Scolopendra, one of the commonest genera of Centipedes.

Scolopendrella is a genus of Arthropods of great interest, as it appears to some extent to combine some of the characters of Insects and Myriapods. The body is composed of numerous segments, which are in the main similar to one another, and are all provided with limbs. In this character it agrees with the Myriapods and differs from Insects, in which the segments of the body are grouped into three dissimilar sets, and those of the hindmost or abdomen have no limbs. The mouth-parts, however, are arranged very differently to anything known among the Myriapods, as they are situated within the head, and not as appendages upon it; in this *Scolopendrella* agrees with some primitive insects, such as the Collembola (q.v.). There are, however, some insects with rudiments of limbs on the abdomen (e.g. on the Thysanura, and the cercopoda on the last segment of Orthoptera, etc.), and thus *Scolopendrella* may be regarded as a primitive type of Insect in which the somites are not very markedly dissimilar, and the limbs of the abdomen still persist.

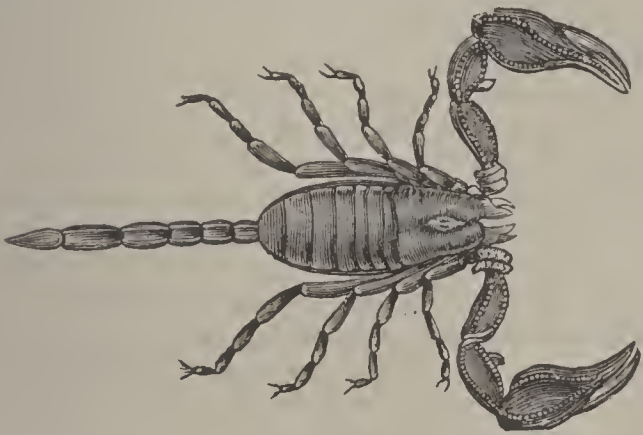
Scolytus. [XYLOPHAGA.]

Scopas, Greek sculptor, almost rivalling Praxiteles, came of a hereditarily artistic family, and flourished in the 4th century B.C. He was born in the Isle of Paros, but very little is known of his life. He built, among many other works, the

magnificent mausoleum at Halicarnassus, and his *Venus* was greatly admired by the ancients, who placed him very high among sculptors. He lived to a good age.

Scoresby, WILLIAM, D.D. (1789–1857), Arctic explorer, was born in Yorkshire, and was the son of a master-mariner, to whom he was apprenticed. Being of a studious disposition, he afterwards entered Edinburgh University, and took a degree. He then became commander of a whaler, and published his work, *The Arctic Regions*, in 1819. After the death of his wife he became a clergyman, but still voyaged occasionally and made some very valuable observations and surveys, and published also the results of some important magnetical researches instituted by him.

Scorpions, or SCORPIONIDÆ, a family of air-breathing Arachnida. It is characterised by the hinder part of the abdomen being constricted into a cylindrical-jointed process (or metasoma), which is armed with a hooked claw and poison gland; by this it is able to inflict a severe sting. The Scorpions strike forward over their head, and in a badly-directed blow the sting may strike some part of the



SCORPION.

body; this often occurs when the animal is dazed by smoke or fire, and thus may have arisen the story about scorpions stinging themselves to death when surrounded by a zone of fire. The scorpions have eight long-jointed legs, and four pincer-like claws; the anterior pair of these is small, and is known as the pair of "chelicerae;" the two hinder pincers are large and strong. The animals breathe by four pairs of lung-sacs, which open to the exterior on the under-side of the abdomen, and four pairs of "stigmata." The Scorpions live in tropical regions under stones and fallen trees; they may be nearly a foot in length. The oldest Scorpions occur in the Silurian rocks, such as *Palæophonus*. *Eoscorpius* is a well-known Carboniferous genus; none occur in the Jurassic rocks.

Scorzonera, a Composite plant (*Scorzonera hispanica*), wild in Western and Central Europe, and cultivated during the last century or century and a half, being sometimes called Spanish Salsafy from its resemblance to *Tragopogon porrifolius*. [SALSAFY.] Its edible root has a brown skin, whence comes the French name *écorce noire* and the Latin name.

Scot, MICHAEL, an occult writer of the 13th

century, was born at Balwearie in Fifeshire, and was believed to be a magician on account of his knowledge of the occult sciences. He travelled in France, Germany, Norway, and England, and is referred to by Dante as a magician. He commented on Aristotle, and wrote other works, which are believed to have been buried with him. He sought the philosopher's stone for many years, dying in 1293.

Scoter, or SURF-DUCK, any oceanic duck of the genus *Œdemia*, with five species from the Nearctic and Palearctic regions. Three visit Britain in the winter, returning northward in spring. The general plumage of the male is black, and of the female brown.

Scotland, the most northerly portion of Great Britain, has an area of 30,900 square miles and a population (1891) of 4,033,103—i.e. about one-fourth of the area, and about one-ninth of the population, of the United Kingdom of Great Britain and Ireland. The area is divided between a mainland portion and about 800 islands, of which the Hebrides or Western Isles on the W., and the Orkney and Shetland Islands on the N., are the chief groups. Of the islands, only about fifty are more than five square miles in area. The largest are Long Island, comprising Lewis and Harris (860 square miles), Skye (643), Mull (347), and Islay (246), among the Hebrides; Mainland (378), in Shetland; and Pomona (207), in Orkney. The mainland portion has a total length of about 275 miles, a breadth varying from 25 to 145 miles, and so irregular and indented a coast-line (over 5,000 miles long) that no spot in the interior is more than forty miles from the sea. The Scottish mainland is commonly divided into the Highlands and the Lowlands, the former lying to the N. of a line running N.E. from the Clyde opposite Greenock to Stonehaven on the E. coast; but Forfar, Kincardine, the E. and greater half of Aberdeenshire, Elgin, and Banff, together with the flat N.E. portion of Caithness, are reckoned with the Lowlands. The Highlands are intersected from sea to sea by Glen More (or great valley), in which lies the chain of lakes connected by artificial channels to form the navigable Caledonian Canal; and the country to the N. of this line is occasionally distinguished as the Northern Highlands. The Western Islands are sometimes included under the general name of "the Highlands;" but the people of Orkney and Shetland, pluming themselves on their Scandinavian descent, regard themselves as distinct from both Lowlanders and Highlanders. By far the richest, most populous, most industrial, and best cultivated part of Scotland is the plain of the Forth and Clyde, including Fife, which forms the N. part of the Lowlands. Scotland is distinctively a mountainous country. The Highlands are almost covered by the Grampian Mountains—a huge, irregular, lofty mountain-mass, seamed and intersected in all directions by straths and glens (wider and narrower valleys), presenting much grand and imposing scenery. The Cairngorm Mountains form the loftiest group of any size (Ben Macdhui, 4,296 feet; Cairn Toul, 4,241 feet; Cairngorm, 4,084 feet; Ben Avon, 3,843 feet); but the highest summit in

the British Isles is Ben Nevis (4,406 feet), near the W. coast. In the Lowlands there are various distinct ranges or systems, such as the Ochill Hills to the N. of the Forth, and to the S. the Lammermoors, the Lowther Hills, and the Cheviots on the



MAP OF SCOTLAND.

English border. The highest summits in the Lowlands are Merrick (2,764 feet), in Kirkcudbrightshire, and Broad Law (2,723 feet), in Peeblesshire. The chief rivers of Scotland are the Clyde (106 miles), Forth (75 miles), and Tay (93 miles), all of which form wide estuaries or "firths," of great value to shipping. The other numerous rivers are mostly mountain streams of impetuous course and no great depth, but famous for their beautiful scenery and good fishing. The Spey (96 miles), the most rapid river in Great Britain, the Dee (87 miles), and the Don (82 miles) are noted salmon-streams to the N. of the "Highland line." In the S. are the Nith (70 miles) and the Tweed (97 miles), perhaps the most famous of all, which forms the border for about thirteen miles. The famous lochs of Scotland are of two kinds—the sea-lochs or fiords on the W. coast, and the inland lochs or lakes proper. Among the former are the numerous lochs running off the beautiful estuary of the Clyde—Loch Fyne (noted for herrings), Lochs Linnhe, Sunart, Nevis, Hourn, Ewe, Broom, etc. Among the lakes are Loch Lomond (27 square miles)—the largest lake in Great Britain—Loch Ness (19 square miles), Loch Awe (16 square miles), and Lochs Tay, Rannoch, Ericht, Maree, Katrine, and Leven.

The natural resources of Scotland are not great. Less than 25 per cent. of the area (nearly all in the Lowlands) is under cultivation. In the Highlands vast regions are covered with barren moors, interspersed with scanty pasturage, supporting a limited number of sheep, but chiefly valuable as game-preserves for deer and grouse. These so-called "deer-forests" are even destitute of trees, for only about 1,400 square miles in all Scotland are under woods. The main industry in this part of Scotland is deep-sea fishing, without which the crofters or small tenants could scarcely make a living. Kelp-burning and whisky-distilling are minor industries. Agriculture reaches its highest level in the Lothians, Fifeshire, and Aberdeenshire; probably no land in the world is better farmed than the holdings of the Lothian farmers. The hills of South Scotland are among the best sheep-walks in the kingdom. Both the mining and the manufacturing industries are practically confined to the Lowlands. The important coal- and iron-fields of Lanarkshire and Ayrshire support various fairly prosperous, if dingy, towns. Fife also has coal in considerable abundance, and Midlothian has coal, oil-shale, and lead. Glasgow (565,714 inhabitants) is a commercial and manufacturing city of the first importance; and the ship-builders of the Clyde enjoy a world-wide reputation. Forfar and Fife have flourishing manufactures of flax and jute, the linen industry centring at Dunfermline (22,365), the jute industry at Dundee (155,640). Hawick (19,204), Galashiels (17,249), and Selkirk (5,788), on or near the Tweed, are the chief seats of the woollen and hosiery manufacture, which is also carried on at Kilmarnock (27,959). Edinburgh (261,261), a famous educational centre, is the seat of the book-trade and has a large printing business. The chief sea-ports are Glasgow, Leith (69,696 inhabitants, the port of Edinburgh), Greenock (63,498), Dundee, and Aberdeen (121,905). Wick and Fraserburgh are herring-ports. Perth (30,760), Stirling, Ayr (24,800), St. Andrews (6,853) (famed for its golf links), and Dumfries (17,800) are of historical importance only. Oban (4,900), Portree (in Lewis), Stornoway (in Skye), Inverary, etc., are well-known tourist centres, as is also Inverness (19,214), the "capital of the Highlands."

The population of Scotland has increased from 1,608,420 in 1801 to 4,033,103 in 1891. The Celtic Highlanders are quite distinct in history as in language from the Teutonic Lowlanders; and though this distinction is perfectly living to this day and fully understood by the Scots among themselves, it is interesting to note that there is, as against "foreigners," a strong national solidarity that pays more attention to the geographical boundary of the country than to this ethnographical or linguistic division. The language of the Highlands is Gaelic, but of the 231,600 Gaelic-speaking inhabitants returned at the census of 1891 very few were ignorant of English. The language of the Lowlands ("Broad Scots") is an independent development of the original tongue brought to Great Britain by the Teutonic invaders from the Continent, and not a corruption or dialect of southern or book-English. It is, however, no longer the tongue of the educated classes in Scotland,

although it has a rich literature (perfectly distinct from the contributions of Scotsmen to English literature) extending back for 600 years, and still being added to.

Though the Crowns of Scotland and England have been united since 1603, and the Parliaments since 1707, the smaller country has maintained a very distinct individuality, both in the character of its people and in many of its institutions. In Church, law, and education, this is very evident. Apart from the Roman Catholics and a large number of quite insignificant sects, the vast majority of Scotsmen belong to one or other of the three great Presbyterian bodies: the Established Church of Scotland ("the Establishment"), the Free Church of Scotland ("Free Kirk"), and the United Presbyterian Church ("U.P.s"). These three differ from each other on points of Church government (not doctrine), that seem very minute to all but Scottish ecclesiastical politicians, especially since the abolition of patronage in the Established Church, in 1874, removed the chief bone of contention. One important effect of the existence of three such Churches is the fact that in Scotland "Dissenters," as such, have never suffered loss of social status. Ecclesiastically Scotland is divided into parishes, and local government has generally accommodated itself to this division, so that there is but little of that overlapping of jurisdiction that makes English local government such a puzzle to the uninitiated. An excellent system of public parish schools was established by law in Scotland in 1696, and the result is shown in the high level of education among the peasantry. These parish schools, however, have been superseded by Board schools since the Education Act of 1872. The better-class secondary schools are for the most part day-schools, the few boarding-schools being imitated from England. Scotland has four universities; at St. Andrews (founded 1411), Glasgow (1450), Aberdeen (1494), and Edinburgh (1582). These resemble Continental rather than English universities, there being no college-residence and practically no collegiate supervision of the students outside the lecture-rooms. Scotland has retained its own system of law, largely based on Roman law, so that there are considerable divergencies from English law on such points as marriage, land-holding, poor-law, etc., as well as in points of procedure. In every county there are sheriff-courts for minor cases; but the supreme courts are the Court of Session (for civil causes), and the High Court of Justiciary (for criminal cases) at Edinburgh. The House of Lords is the final court of appeal in civil causes.

Caledonia, as Tacitus calls Scotland to the north of the Forth and Clyde, was more than once invaded, but never subdued, by the Romans. Its inhabitants were the Celtic-speaking Picts or Cruithni, who were also found in the south-west of modern Scotland, while the south-east was peopled by Britons. About the end of the 5th century the Scots, a Celtic tribe from the north of Ireland, established themselves in Argyllshire and on the west coasts. Before the time of Bede (8th century) a fourth race, the Saxons, obtained a footing in

the south-east, while the Scandinavians had long before acquired power in the Orkneys and the western islands. The Scots gradually gained the upper hand, and about 843 Kenneth Macalpin became king of the Scots and Picts, his kingdom (wholly to the north of the Forth and Clyde) being known as Alban. The name Scotland first emerges in the 10th century. Christianity was introduced among the South Picts by St. Ninian in the 4th century, and to the North Picts by St. Columba in the 6th. The successors of Kenneth extended their power southwards, up to and beyond the present border, but the far north and the distant islands long remained practically independent. Under Malcolm (III.) Canmore (1058-93), who succeeded the able usurper Macbeth and had married the English princess Margaret, the English language and customs gained ground; but immensely greater strides in civilisation and in the organisation of Church and State were made under David I. (1124-53), the "Scottish Alfred." William the Lion (1165-1214), captured by Henry II., regained his freedom by an illegal oath of fealty, which, though remitted by Richard I. in 1189 for a payment of money, was long afterwards the pretext for much unhappy interference in Scottish affairs on the part of the English kings. From William's reign also dates the first of the alliances with France, which have left many traces on later Scottish history. The wise and beneficent Alexander III. (1249-86) was succeeded by his infant granddaughter Margaret, "the Maid of Norway," who died in 1290, on her way to Scotland. Edward I. of England, invited to act as umpire in the ensuing dispute as to the succession between John Baliol and the elder Bruce, decided in favour of the former (1292). Baliol, however, was carried prisoner to London in 1297, and Edward, in his efforts to reduce Scotland under his own sceptre, was confronted by the patriot William Wallace, who, after some successes, was captured and beheaded in 1305. The struggle for freedom was carried on by Robert Bruce (1306-29), who finally triumphed at Bannockburn in 1314. Robert II. (1370-90), Bruce's grandson, and Robert III. (1390-1406), the first two kings of the Stuart dynasty, were succeeded by five Jameses in succession. James V., dying in 1542, left the kingdom to his infant daughter Mary (1542-87), afterwards the famous "Queen of Scots," whose career fills so romantic a page of history. Mary abdicated in 1567 in favour of her son James VI. (1567-1625), who succeeded to the English throne in 1603, thus uniting Great Britain under one Crown. The history of Scotland under the earlier Stuarts is a record of fierce struggles between the Crown and the powerful nobles, punctuated by difficulties with the turbulent Highlanders, and by costly wars with England, culminating in the disaster of Flodden (1514), where James IV. perished with the flower of the country. The condition of the people, at least in the south, was, however, gradually improving, and this period added many famous names to Scottish literature. The reformed religious doctrines penetrated to Scotland early in the 15th century, and, championed latterly by John

Knox, were formally approved by the Parliament in 1560. The Scottish reformers and common people were Calvinistic Presbyterians, while James VI. and his successors were zealous adherents of Episcopacy. This difference of opinion developed under Charles I. (1625-49) into open and bitter strife; and on the outbreak of the great Civil War Scotland joined the English Parliament against the king. On the execution of Charles I., however, Charles II. (1649-85) was immediately proclaimed king in Scotland, but Cromwell, and afterwards Monk, effectually made themselves masters of the country. After the Restoration in 1660, the religious troubles in Scotland again broke out, the Covenanters resisting to the death the introduction of Episcopacy. The persecution was but slightly relaxed under James VII. (1685-88), but religious freedom was finally attained under William and Mary (1688-1702). The Scottish and English Parliaments were united in 1707, in the reign of Anne (1702-14), the younger daughter of James VII., but there still lingered a certain jealousy between the two nations, which encouraged the Jacobites, or adherents of the expelled Stuarts, to rise in 1715 and again in 1745 (under Prince Charles Stuart). These risings were firmly quelled, and, the advantages of an alliance with a rich and prosperous country gradually making themselves felt, Scotland settled down into a loyal and useful member of the United Kingdom. Its subsequent general history is substantially identical with that of England.

Scots Guards, a name now used for a celebrated household regiment in the British army (till lately, Scots Fusilier Guards), but also applied to the Scottish troops who for many centuries served under the kings of France. The alliance of the two countries was due to their common enmity to England brought about by the ambitious designs of Edward I. The nucleus of the Scottish forces in the French army was a body of nearly 10,000 men led by the Earl of Buchan, which disembarked at La Rochelle in 1419. Charles VII. divided these Scotsmen into two distinct corps—"Les Gendarmes Écossais" (the Scots men-at-arms), and "La Compagnie Écossaise de la Garde de Corps du Roi" (the Scots Lifeguards). The loyalty of the Scots Guards was not more conspicuous than their heroism in battle, and they played a distinguished part in the wars of Charles VIII., Louis XII., and Francis I. They ceased to be composed of Scotsmen after the Seven Years' War, and were disbanded at the Revolution. Their final abolition took place in 1830.

Scott, DAVID (1806-49), Scotch painter, was born in Edinburgh, and learned his art from his father, a clever artist. He began to exhibit at an early age, but met with some rebuffs, which he keenly felt. Perhaps his earliest artistic achievement of note was his illustrations for Coleridge's *Ancient Mariner*, which are admirable, as are also those designed by him later for *The Pilgrim's Progress*. He excelled in the weird and imaginative style. In 1833 he visited Rome, and produced some admirable pictures there. His *Vasco de Gama Encountering the Spirit of the Cape*, which some

consider his masterpiece, was exhibited in 1847. He competed for the decoration of the Houses of Parliament, and the disappointment caused by his non-success hastened his death. He was a member of the Royal Scottish Academy. His brother, W. Bell Scott (q.v.), published his life in 1850.

Scott, MICHAEL (1789-1835), novelist, was born in Glasgow, and at the age of seventeen went to Jamaica, where he stayed sixteen years. On his return he engaged in commercial pursuits, but found leisure to write and publish his *Tom Cringle's Log*, which appeared anonymously in *Blackwood's Magazine*, and came out in a volume in 1834, and *The Cruise of the Midge*, which was published in volume form in 1836. They were both very popular, the first being perhaps the most striking sea-story ever written.

Scott, SIR WALTER, was born on August 15th, 1771. The descendant of an old clan, he was early filled with reverence for the past, which was fostered by his mother's tales of bygone days. As a child, he developed a lameness which lasted through his life, but never interfered with his enjoyment of all kinds of exercise. "Always the more mischief the better sport for him," wrote a witness of one of his freaks in a boat; and his love of outdoor pursuits was increased by a hospitality which made him happiest when the centre of the largest party. His sympathy won the affection of all classes. "He was the only one," said Hogg, "I ever knew whom no man, either poor or rich, held at ill-will," and his kindness, extending itself beyond his friends, constituted almost a personal tie between him and his horses and dogs. He was an ideal Scotch laird, and people wondered when he found time for his literary labours; yet in this profusion of enjoyment, his life was filled with hard and varied work.

During his education at Edinburgh High School, and at Kelso, he learned no Greek, but gained a knowledge of Latin, to which he added a study of Italian and Spanish. On leaving school he attended classes at the university of Edinburgh, and served an apprenticeship to his father, a writer to the signet. Five years of his youth were passed in love for Miss Stuart Belches, who married his friend, Sir William Forbes, in 1796. In the following year he married Miss Charpentier or Carpenter, a lady of French descent, by whom he had four children, who all survived him for a short time. His practice at the bar, to which he had been called in 1792, was never great; but two years after his marriage he was made sheriff of Selkirkshire, and in 1812 clerk of session. These appointments, together with his success in literature, enabled him to indulge his desire to possess an estate. He therefore purchased Abbotsford, where he spent much of his time and money in planting and building. In 1815 he refused the laureateship, which, at his request, was given to Southey. In 1818 the Prince Regent offered him a baronetcy, which he accepted, although he did not assume the title until 1820. Meanwhile his expenditure at Abbotsford, and his secret connection with the publishing and printing firms of the Ballantynes,

were preparing a disaster. His partners became involved in the bankruptcy of Constable at the end of 1825, and Scott found himself confronted with a debt of £117,000. This he determined to pay with his pen, and in five years he actually reduced it to £54,000, by writing entirely for his creditors. In 1826 his wife died; in 1830 he had an attack of paralysis. His brain was affected, and in the following year he tried a journey to Italy, without success. He returned to Abbotsford, where he died on September 21, 1832.

His literary work began with a translation from Burger in 1796, and a translation of Goethe's *Götz von Berlichingen* in 1799, but his mark in his own department was made in 1802 with his *Minstrelsy of the Scottish Border*. In 1805 *The Lay of the Last Minstrel* brought him immediate popularity. *Marmion* appeared in 1808, *The Lady of the Lake* in 1810, *Rokeby* and *The Bridal of Triermain* in 1813, and *The Lord of the Isles* in 1815. Meanwhile Scott had felt his inferiority to Byron in poetry, and had determined to try his powers in prose. He took up the first chapters of *Waverley*, which he had thrown aside some years before, completed the story in a few weeks, and published it in 1814. Its reception, in spite of the anonymity on which Scott insisted for all his novels, until the year 1827, was so favourable that it decided the author's future. The rest of the Waverley Novels followed in rapid succession right up to 1832, some of them published as separate stories, others as parts of the various series of *Tales of my Landlord*, and *Chronicles of the Canongate*. Scott, however, displayed his activity not only in poetry and fiction; he edited State papers, poured forth article after article, published biographies of Dryden (1808), and Swift (1814), with editions of their works, and brought out a life of Napoleon Bonaparte (1827). His *Tales of a Grandfather* appeared in three series in 1828, 1829, and 1830. The popularity gained by his first poem, and increased by each subsequent work, has never been lessened. The influence of Scott has been marked in the development of romantic literature in England and France, while the glamour which he threw around the life of the Middle Ages admittedly contributed to the ecclesiastical movement caused by the Oxford *Tracts for the Times*. The secret of his power lies not in the subtle analysis of character, but, as he himself recognised, "in the hurried frankness of composition, which pleases soldiers, sailors, and young people of bold and active dispositions." With no deep spiritual message, he teaches a doctrine of broad, sound life, and, as one of his biographers has observed, he takes his readers out of the trivial interests of private society, and places them in the current of national feeling. It is not too much to say that he has transformed the past into a living present, and thus already has quickened the study of history for several generations.

Scott, WILLIAM BELL (1811-93), critic, painter, and poet, was born in Edinburgh, and commenced to write for periodicals in early youth. He came to London, where he produced many pictures

and poems, and some valuable critical biographies. His best-known works are *Half-hour Lectures* (1861); *Albert Dürer* (1869); *William Blake* (1878); and his *Poems by a Painter* (1854), and the biography of his brother David. He was art examiner under the Education Board.

Scott, WINFIELD (1786-1866), American soldier, was born in Virginia, and, studying law, was called to the bar in 1806. He entered the army as a lieutenant in 1808, and in 1812 had risen to the rank of lieutenant-colonel. He was sent to the Canadian frontier, and saw some fighting there, becoming brigadier-general in 1814. He was severely wounded more than once, and after the war was offered the post of Secretary of War, but declined it, Congress thanking him for his services and promoting him. He was sent on several expeditions against the Indians, and in 1841 became Commander-in-Chief of the United States army. He commanded during the Mexican War, and captured Vera Cruz and other places, finally entering the city of Mexico in September, 1847. He retired from active service in 1861. He was a great tactician, a man of commanding presence, and a stern disciplinarian, and wrote some excellent works on military tactics.

Screamer, any bird of the South American family *Palamedeidae*, allied to the ducks and geese. There are two strong spurs on each wing. The Horned Screamer (*Palamedea cornuta*), rather smaller than a turkey, has blackish-brown plumage and an erectile horn on the head. The Crested Screamer (*Chauna chavaria*), and the Darbian Screamer (*C. derbiana*), have erectile feathers, but no horn. The former is domesticated and allowed to run with poultry that it may defend them from the vultures.

Screen, as an architectural term, denotes a partition separating one portion of a chamber or an edifice from the remainder. In the halls of mediæval residences the space thus cut off formed a lobby which communicated with the hall proper through doors in the screen, and was surmounted by a gallery. These screens were of wood, and consisted of close panelling below, and open work above. In churches, screens separated chapels from the nave, choir, or aisles, or they were put up as a protection to tombs; but the most important was the rood-screen, which divided the nave from the choir. It was so-called because, prior to the Reformation, it was surmounted by a figure of the rood or cross. As a general rule, the upper part of church screens was open, but in cathedrals and large churches the rood-screen was close throughout. These screens, which were constructed either of wood or stone, were very elaborately carved and also ornamented with painting and gilding.

Screw may be regarded as an inclined plane or wedge wrapped round a cylinder. If a screw has n threads per inch, it is clear that a nut which fits it will move relatively to it through a distance of $\frac{1}{n}$ of an inch, if one is rotated through a complete turn with regard to the other. A lever of some

kind (such as a screwdriver or spanner) is usually used to turn the screw or nut; and, if the turning force be so applied at a radius r inches, this force will act through a distance of $2\pi r$, while the nut or screw moves through a distance $\frac{1}{n}$; the mechanical advantage will, therefore, be $2\pi rn$. In practice about $\frac{1}{3}$ of the applied force is lost in friction. The screw is employed in various mechanisms, such as the screw-press, screw-jack, etc.; in such cases the relative motion of the screw and its nut is arranged to produce the desired effect. A fine-threaded screw is often used for measuring small distances. [MICROMETER, SPHEROMETER.]

Scribe, AUGUSTIN EUGÈNE (1791–1861), French dramatist, was the son of a silk mercer, and was born at Paris. He gave up the study of law, and began to write plays, of which he produced an enormous number, making a very large fortune by his industry. His most successful pieces were *Bertrand et Raton*, *Le Verre d'Eau*, *La Camaraderie*, and *Adrienne Lecouvreur*. His first play was produced in 1810, but it was not till 1815 that he achieved a notable success. He wrote many of the libretti for Meyerbeer and Auber's operas. In 1836 he became an Academician.

Scribes (Heb. *sopherim*), a class of Hebrew officials, who appear to have originally exercised military functions. Afterwards the name was applied to those who copied the books of the law. After the return from the Captivity they seem to have been recognised as its interpreters also. Thus the term came to denote a man learned in the law, and eventually the Scribes occupied a threefold position, preserving the body of law and tradition, holding public classes in the Temple, and administering the law in the courts of justice.

Scrivener, REV. FREDERICK HENRY AMBROSE, LL.D., D.C.L. (b. 1813), Biblical scholar, was born at Bermondsey, and graduated at Cambridge. He studied the Scriptures, and made himself a great authority on the New Testament. He was appointed in 1870 as one of its revisers, and in 1872 was granted a Civil List pension for his great services to Biblical criticism. He has published some valuable critical editions of the Gospels in Latin and Greek.

Scrivener's Palsy. [WRITER'S CRAMP.]

Scrofula (*serofa*, "a sow"), a term which has had various significations at different times, but which is particularly associated with conditions of anæmia and with glandular enlargements such as occur where there is development of tubercular mischief in lymphatic glands. Since knowledge of the local manifestations of tubercle has increased, the term "scrofula" has been less frequently used.

Scrophulariaceæ, a large order of hypogynous Gamopetalæ, including about 180 genera and 1,800 species. They are mostly herbs, the members of one sub-order, the *Rhinanthææ*, being often partially parasitic on roots. Their leaves may be opposite or scattered, and are exstipulate and simple. The inflorescence is various, but generally racemose, and

the flowers are generally monosymmetric. The lobes of calyx and corolla are four or five in number, and the latter may be personate, sub-campanulate, sub-rotate, bi-labiate, or rotate. It is generally conspicuously coloured, pollination being effected by insects. The stamens may be two or five, but are generally didynamous; and the ovary is two-chambered and generally many-ovuled. The fruit is capsular, and the seeds are albuminous. The order is distinguishable with difficulty from the Solanaceæ, Acanthaceæ, and Bignoniaceæ, and is subdivided mainly according to the variations in the imbricate æstivation of the corolla. It includes many favourite garden flowers, such as the snapdragons, foxgloves, *Calceolaria*, *Mimulus*, *Pentstemon*, and *Veronica*, the interesting British semi-parasitic cow-wheat, eye-bright and red and yellow rattles, etc., but few plants of economic value.

Scudéry, MADELEINE, MADAME DE (1607–1701), French romancist, was born at Havre, and was left an orphan at six years of age. After being educated by her relatives, she went to Paris and joined the Rambouillet circle, and was considered one of its brightest ornaments. Her brother GEORGE was a popular writer, and it is known that she wrote some of his works. She was very fond of society and pleasure, but always did a considerable amount of writing every day. Her novels or romances, which were tremendously successful, are very voluminous, and to the modern reader are very tedious reading. Even in other countries her *Célie* (10 vols., 1656), and *Artamene, ou le Grand Cyrus* (10 vols., 1649–53), and other works, were widely read. There is much affectation in them, and the *Map of Tenderness* in the first-named work has been often ridiculed. Her *Letters*, being more natural, are better than her romances.

Sculpture is the art of producing artistic forms either by cutting wood, stone, or some other hard material, or by moulding a soft substance, such as clay or wax, into the desired shape. In the former case, the sculptor either gives an artistic outline to a level surface, or forms a mass of his material into the likeness of some object. As an independent art, it is the peculiar province of sculpture to imitate the living form; but when subordinated to architecture it serves the purpose of decoration, and its treatment is more or less conventional. The prevailing consideration which invariably guides the sculptor is the nature of the material in which he works. It is impossible to produce with terra-cotta those severe and majestic effects which are easily attainable for the artist in porphyry or granite; but, on the other hand, it is well adapted to the expression of lively and graceful movements. Again, a true artist engaged in the ornamentation of a building like the Parthenon will not think merely of the pictorial effect of the work on which he is immediately employed; he must consider the outline and dimensions of the space which he has to fill, so that the general effect of the whole may be harmonious and restful to the eye. The ancient Egyptians were the first people who raised sculpture to the position of an art. Their reliefs

and colossal monuments, executed in syenite and basalt, of which the Sphinx (q.v.) is the most noteworthy example, are marked by a severe dignity and repose, but they are lacking in vitality and freedom. The close connection between the arts and the esoteric religion of the country prevented

the development of sculpture in a humanistic direction, such as afterwards took place among the Greeks. The most flourishing period of Assyrian sculpture seems to have been the 9th and 8th centuries B.C. Notwithstanding the cramping effects of religious tradition, it shows a realistic spirit and a regard to detail of which there is no trace in the Egyptian monuments; but, on the other hand, it lacks the serenity and grandeur for which the latter are so conspicuous. It is doubtful whether Greek sculpture derives its original impulse from Egypt or Assyria, or whether, again, it may be regarded as purely indigenous. In any case, it had completely changed its character by the middle of the



THE VENUS OF MILO.

5th century, and the monuments erected at Athens during the age of Pericles may be regarded as the direct product of the Greek genius. Some indication of its capabilities had already been given in the marble statues for the pediment for the temple of Athene at Ægina, which date from about 475 B.C., and are now preserved in the Glyptothek at Munich; but in the hands of Phidias (q.v.) sculpture reached a point beyond which it is improbable that it will ever advance. His magnificent statues of Zeus and Athene have perished, but specimens of his art remain in the mutilated frieze and metopes from the Parthenon, known as the Elgin Marbles (q.v.), which are now in the British Museum. The peculiar characteristic of the Greek genius—the faculty of presenting the highest type of physical beauty without any admixture of extravagance or loss of self-control—is nowhere more conspicuous than it is in these sculptures. Scopas (390–350) and Praxiteles, the chief representatives of the next age, abandoned the calm grandeur of Phidias in the effort to give expression to deep and passionate emotion. Scopas executed the sculptures for the Mausoleum or tomb of Mausolus at Halicarnassus (352 B.C.). The *Hermes* discovered at Olympia in 1877 is known to be the work of Praxiteles, but for further knowledge of him and his disciples we are wholly indebted to copies preserved at the Vatican and elsewhere and descriptions

by ancient writers. The *Venus of Milo* or *Melos* and the *Demeter of Unidos* are assigned by some authorities to this period. The group of Niobe and her children was attributed alike to Scopas and Praxiteles. Between the death of Alexander the Great (323) and the incorporation of Greece in the Roman Empire (146) important schools flourished at Rhodes and Pergamus, represented respectively by the famous *Laocöon* and the *Dying Gladiator* in the Capitoline Museum. The *Apollo Belvidere* and the *Venus de Medicis* were produced at a time when Attic art had been transplanted to Rome.

From the 2nd to the 4th century A.D. Roman sculpture steadily declined, but the progress of Christianity from the time of Constantine led to a partial revival of the art under new influences. The scorn of the flesh, however, which formed so marked a feature of the mediæval Church, greatly impeded its free development; so that the excellence of the Byzantine school, which dominated Europe from the 6th to the 12th century, lay rather in the technical minutiae of design than in the portrayal of the human form. The sudden growth of Gothic architecture gave a new impetus to ecclesiastical sculpture, which in the twelfth century began throughout Western Europe to show a new spirit free from the trammels of Byzantine tradition. Its highest result was the magnificent figure-sculpture, the finest English example of which

is the thirteenth-century work at the west-end of Wells cathedral. The French sculptors, however, far outstripped those of other countries, and neither England nor Germany can exhibit anything at all comparable with the sculpture on the three western doors of the cathedral at Chartres. The decline of Gothic architecture which began in the 14th century seems to have been fatal to the sister-art, which, after all, occupied only a subsidiary position in those countries where the Gothic spirit had been fully realised. In Italy, on the other hand, Niccolò Pisano (b. 1205) and his son Giovanni, who were influenced as much by Classical as by Gothic tradition, regarded excel-

lence in sculptural ornament as an end in itself. It is the great merit of the Pisani and their followers that they were able to carry their sculptured work to so high a pitch of excellence without injury to the architectural effect of the buildings for which they were designed. In Jacopo della Quercia



THE VENUS DE MEDICIS.

(1374-1438) the influence of the Renaissance is already apparent. The work of Lorenzo Ghiberti (1381-1455), although it is marred by insufficient regard to architectural considerations, shows a further advance in the same direction. The two great sculptors of the Italian Renaissance—Donatello (1386-1468) and Michelangelo (1475-1564)—



THE DAVID, BY MICHELANGELO.

form a strong contrast, for whereas the former is conspicuous among the moderns for the breadth, simplicity, and restraint of his style, Michelangelo's works seem to be the involuntary productions of a passionate and uncontrolled genius. His worst faults were imitated by his successors; and the brief glory of the Renaissance, after awakening Europe from its æsthetic stupor, was followed by a sterile period, in which the quality most valued in the artist seems to have been a shallow cleverness in producing fantastic effects. The great portrait-sculptor, Jean Antoine Houdon (1740-1828), restored to the art something of its lost dignity. In Italy

Antonio Canova (1747-1822) attempted to model his style on Classical rather than Renaissance models, but with very varying success. He was followed by Bertel Thorwaldsen (1770-1844), a Dane of Icelandic origin, whose best work has a closer affinity with the sculpture of ancient Greece than that of any other modern artist. The chief representative of this school in England was John Flaxman (1740-99). During the century which followed his death English sculpture was conspicuous only for its tameness and insipidity. Neither Chantrey (1782-1841) nor Gibson (1790-1866) was by any means equal to Flaxman in genius; but England has produced at least one modern sculptor of undoubted power in Alfred Stevens (1817-75), author of the magnificent monument to the Duke of Wellington in St. Paul's Cathedral.

Sculptured Stones, a name given to the monumental stones erected in the British Isles during the centuries which followed the introduction of Christianity. The earlier specimens are mostly unhewn and very rude in character. They have been divided into four classes—(1) those which bear Latin inscriptions in Roman capitals cut into the stone; (2) those in which a Keltic inscription in Ogam characters cut into the stone on one side

corresponds to a Latin inscription in Roman letters (usually capitals) on the other; (3) those with Ogam inscriptions only; (4) those with inscriptions in Roman minuscules. This classification of the stones corresponds with their chronological order. The most important examples of the two former classes are found in Wales, of the two latter in Ireland; but all four are represented in England and Scotland also. The incised inscription commemorating the person buried at the spot is frequently accompanied by an incised cross, and the stones of the third class are also ornamented with designs in relief of the type common in Keltic manuscripts of the Gospels; in the fourth class, of which there are numerous examples in the cemetery at Clonmacnois, the ornamentation is incised. There are also many sepulchral stones with Runic inscriptions, both Anglian and Scandinavian. The finest examples of this class are cut in the shape of crosses with elaborate ornamentation. That at Ruthwell, in Dumfriesshire, preserves twenty-one lines from an Anglo-Saxon poem, *The Dream of the Cross*, ascribed to Cynewulf, of which no other copy was known before the discovery of a MS. in 1823. The sculptured stones peculiar to Scotland, dating probably from the 7th to the 12th century, seldom bear inscriptions, but they display much rich ornamentation in relief, together with certain symbols (such as the mirror and comb) which do not occur elsewhere and the meaning of which is unknown.

Scurvy, a disease characterised by debility, bloodlessness, swollen gums, and a tendency to the occurrence of hæmorrhages. It is produced by a deficiency of vegetable diet, and has from time to time worked much mischief among armies in the field and ships' crews whose diet has not been properly regulated. It is clear that the malady is brought on by the exclusion of fresh vegetables from the dietary, but there is some uncertainty as to the particular elements to the absence of which the disease is attributable. Some authorities say scurvy is produced by the lack of vegetable acids; others by a failure of the adequate supply of potash salts. Since the importance of the adoption of preventive measures has been recognised, the disease has become rare. In the navy lime-juice or lemon-juice is periodically administered to the crews of vessels on long voyages.

Scutari (Turkish *Uskudar*, classic *Chrysopolis*).

1. A port on the E. shore of the Bosphorus, opposite Constantinople. It is a bright and busy town, containing a seraglio, eight mosques, large bazaars and barracks, and an enormous cemetery, the burial-place of the British who died in hospital here during the Crimean War. Arms, saddles, and fabrics of silk and cotton are largely manufactured. On a rock close to the shore stands the fabled Leander's Tower, now a lighthouse.

2. (Turkish *Scodra*, Slav *Skadar*), the capital of Northern Albania, is a fortified seaport occupying a promontory in the Adriatic close to the mouth of the Bojana, which drains the Lake of Scutari to the N. A good trade is done with the Adriatic ports and the interior. Arms and cotton goods are manufactured.

Scylla, a mythological personification of the waves off the coast of Sicily. According to the Greeks, she was once a beautiful maiden, changed by Circe, in a jealous fit, into a hideous monster with six heads. She leapt into the sea at Messina, and her cries were often heard by mariners.

Scyphostoma is a stage in the life-history of some of the Hydrozoa belonging to the subclass Acraspeda (q.v.). It consists of only a small fixed tube resembling the common fresh-water polype or Hydra; it is therefore known also as the "Hydra tuba." It occurs in the members of the *Ephyronice*.

Scytodermata, a synonym of Holothuroidea (q.v.) or Sea-cucumbers.

Sea, the general name for the *hydrosphere* or water-shell resting in the hollows of the globe and covering about 72 per cent. of its surface, or about 58 per cent. of the northern, and about 83 per cent. of the southern hemisphere. In the hemisphere of which New Zealand is the centre two-thirds of the entire ocean-surface is situated, only 8 per cent. being land. Most of the hydrosphere is a connected whole, the Caspian being the only considerable isolated area of sea or truly *inland sea*, though there are many nearly land-locked or *mediterranean seas*. It is usual to divide the hydrosphere into four oceans, the Atlantic, Pacific, Indian, and Southern, the Arctic being considered as part of the first-named. The Atlantic Ocean thus considered has an area of 33,000,000 square miles, and receives the rivers of half the land area of the globe. It has as more or less enclosed portions the Arctic, Kara, White, Norwegian, North, Baltic, Black, Ægean, Adriatic, Mediterranean, and Caribbean Seas, the Gulf of Mexico, and Hudson's Bay. The Pacific Ocean, the largest in area, covers 55,000,000 square miles, an area equal to the entire land-surface of the globe, and has as enclosed portions the Behring, Okhotsk, Japan, Yellow, China, Celebes, and Arafura Seas, and the Gulf of California. The Indian Ocean covers 17,000,000 square miles, and has the Red and Bengal Seas and the Persian Gulf as partially enclosed areas. The Southern Ocean, extending from 40° south to the ice of the Antarctic land, covers about 30,000,000 square miles.

Sea-water contains on an average 3·5 per cent. by weight of saline matter, and is, therefore, about 2·6 per cent. more dense than pure water. The saline matter consists of over 77 per cent. of common salt (sodium-chloride), nearly 11 per cent. of magnesium-chloride, an equal percentage of sulphates of magnesium, calcium, and potassium, and very minute traces of carbonates of calcium and magnesium and of silica. These salts give to sea-water a bitter as well as a salt taste. Whilst the Baltic is exceptionally fresh, the Mediterranean and Red Seas are the regions of saltiest water. It has been calculated that the salts in the ocean would cover its surface 170 feet deep. Sea-water is aerated by the action of waves at the surface, and the dissolved gases being circulated by convection-currents, respiration is rendered possible

for marine organisms at all depths. Sea-water freezes at 28° F., most of the salts separating out in the process, thus yielding nearly fresh ice with more saline water below. The Arctic Sea is mostly frozen over every winter, the *floe-ice* being from 2 to 10 feet thick; but Sir George Nares, finding floes over 150 feet thick, estimated that they might be five hundred years old, and named that part of the Arctic the *Palæocrystic Sea*. In the tropical zone the surface-water has an annual temperature exceeding 80° F., but in the Red Sea 90° and 100° have been recorded. At 300 to 400 fathoms below the surface a temperature of 40° is common in all latitudes, whilst at greater depths it is only in polar regions that the temperature falls below 30°.

Dr. John Murray considers half the globe to be covered with water over 10,000 feet deep. This he terms the *abysmal area*. About 22 per cent. of the surface, covered by more shallow water, he terms the *transitional area*, the remainder being the permanently *continental*, or land, *area*. The average depth of the sea is 2,100 fathoms (12,600 feet), the deepest abyss, that known from the United States exploring vessel as the *Tuscarora Deep*, between 20° and 50° N. lat. in the Pacific, almost reaching 4,700 fathoms. The movements of the sea include tides (q.v.), waves (q.v.) due to wind, currents (q.v.) of surface-water, due mainly to the constant winds, and circulation by convection-currents, produced by concentration by heat in the tropics, and by freezing in polar seas, by dilution with fresh-water, and possibly by other causes affecting temperature. The sea equalises temperatures, keeps up breezes and monsoons, supplies the atmosphere with its water-vapour, is constantly tending by its waves and shingle to wear down its coasts to a plane, and is the receptacle, not only for *terrigenous* deposits formed from the wear and tear of the land, but also for *pelagic* deposits, or *oozes*, formed in deep water, far from land, by the slow accumulation of minute organisms, decomposed pumice, and meteoric dust. The terrigenous deposits, besides gravels and sands, consist of *muds*, including *coral mud*, *volcanic mud*, and widely-distributed *blue mud*, coloured by iron sulphide and ferrous oxide, and *green mud*, coloured by glauconite (q.v.). The pelagic deposits include the oozes known, from their prevailing organisms and colours, as the *pteropod ooze*, the *Globigerina* or *white ooze*, and the *straw-coloured* or *radiolarian* and *diatomaceous oozes*, of which the two former are mainly calcareous, and the two latter mainly siliceous, together with a very ubiquitous *red clay*, which covers half the floor of the Pacific. This consists of the residue of dissolved Globigerina ooze, of waterlogged pumice, and of meteoric and volcanic dust, and contains manganic nodules, crystals of zeolites (q.v.), and numerous slowly-encrusted shark's teeth.

Sea-Anemone. [ACTINIA.]

Sea-Bear. [SEAL.]

Seabury, SAMUEL (1729-96), first Bishop of Connecticut, was the son of a clergyman of that state, and graduated at Yale College in 1748. He

was ordained in London in 1753, but, as he was prevented from officiating for a time, he supported himself by practising medicine. He made many enemies among the American party by the pamphlets he wrote from the British standpoint. He was an excellent preacher, however, and in 1777 was made a D.D. of Oxford, and in 1783 obtained the see of Connecticut.

Sea-Fir, or *SERTULARIA ABIETINA* (Linn.), is a species of zoophytes belonging to the family of *Sertulariæ* and the order Hydroidea (q.v.). As it is one of the commonest members of this group, the popular name is sometimes extended to include them all, such as the Sea-tamarisk (*Diphasia tamarisca*, Linn.), the Sea-pine Coralline (*D. pinaster*, Ell. and Sol.), the Podded Coralline (*Aglaophenia pluma*, Linn.), etc. The group are all marine, and are plant-like in form. The skeleton is horny or chitinous, repeatedly branched, and is attached to rocks and shells. The zoophyte is colonial, many different polypites or individuals uniting to form a fixed colony or hydrosoma. This is composed of a chitinous or horny crust known as the perisarc, which surrounds and protects the softer tissues. Each polypite is protected by an expansion of the perisarc forming a cup or hydrotheca. The polypites are of two types of structure; they are modified to serve either for nutrition (the hydranths), while another set (the gonothecæ) serve for reproduction. The skeleton consists of two parts: the basal hydrorhiza by which it is fixed, and the hydrocaulus, or the erect, branching stem; the two form the hydrophyton. In some genera, otherwise resembling the Sertularians, there are no hydrothecæ to protect the polypites; these form the order Athecata, while the Sertularians belong to the order Thecaphora. The Campanularians are familiar representatives of the former. The Sea-firs and their immediate allies are marine.

Seagull. [GULL.]

Seakale (*Crambe maritima*), a British sea-side perennial plant belonging to the order Cruciferae, with broad wavy glaucous leaves, and white, honey-scented flowers. Though used in ancient times and by inhabitants of the coast, it was only introduced into our kitchen gardens about a century ago. It is earthed up, and the blanched stems and leaf-stalks are eaten boiled.

Seal, a die of stone, metal, or some other hard material, on which is engraved a device or motto to be stamped either on paper or on clay, wax, or some other substance in a plastic state to denote the source from which a document proceeds; also the actual impression which is thus produced. The ancient Egyptians frequently had seals attached to their rings, and the practice of sealing passed from them to the Romans. The *bullæ* or impressions on lead introduced by the emperors who succeeded Constantine were likewise used as signatures by the Popes, who fastened them to documents with bands of silk or wool. The seals of the French kings from the Merovingian period downwards form an interesting collection. In

England under the Norman kings a seal affixed to a deed became a legal proof of its authenticity. It is still required to give validity to an instrument conveying real estate, but as subscription is also necessary the process of sealing is merely formal. Corporate seals have been used by towns and boroughs since the 12th century.

The *Great Seal* is the emblem of sovereignty, and is used on all solemn occasions when the will of the sovereign is to be expressed. A new Great Seal is provided by the king in council at the beginning of each reign or whenever a change is made in the royal arms or style, the old one being publicly broken. It was introduced into England by Edward the Confessor, who committed it to the care of the Chancellor. When the office of Chancellor was vacant through death or resignation, the Great Seal was placed in the hands of a temporary keeper, who gradually came to exercise all the functions connected with its use. Since the accession of George III. the office of Lord Keeper has been discontinued. The Great Seal was also occasionally placed in commission. By the Act of Union with Scotland one Great Seal is used for the United Kingdom in all matters of public import, but the Act of Union with Ireland contained no similar provision.

The *Privy Seal* is affixed to letters-patent for the grant of charters, etc., before they come to the Great Seal, and to documents of minor importance which do not pass the Great Seal at all. The office of Clerk or Keeper of the Privy Seal, now called Lord Privy Seal, is of Norman origin. In the reign of Henry VIII. the Privy Seal was made the warrant of the legality of letters-patent from the Crown, and authorised the Lord Chancellor to affix the Great Seal. By the 47 & 48 Vict., cap. 30, however, a warrant under the royal sign-manual, regularly countersigned, has taken the place of the Privy Seal as an authority for affixing the Great Seal.

Seal, a general name (in many cases with an epithet) for any of the Pinnipedia or Fin-footed Carnivora, with the exception of the Walrus (q.v.). All are aquatic and nearly all marine, but some enter large rivers, and two species are found in inland lakes. The limbs bear five digits united to the extremities by a strong web, and are modified to form powerful swimming organs. The tail is always short. Seals are widely distributed, but are most abundant in the cold and temperate regions of the northern and southern hemispheres. They feed on fish, crustaceans, and molluscs. There are two families—the *Otariidæ* or Eared Seals, forming a connecting-link between the Land Carnivora and the *Phocidæ* or True Seals. In the first family there is a small external ear, and on land the hind limbs are directed forward, thus acting as supports for the body; while in the True Seals they are directed backward. The palms and soles of the Eared Seals are naked; those of the True Seals are covered with hair. The Eared Seals are natives of the North Pacific and the South Atlantic coasts, the Cape of Good Hope, Australia, and some of the neighbouring islands. They are popularly known as Sea-bears

and Sea-lions, according as they do, or do not, possess the close under-fur which forms the "seal-skin" of commerce. These animals form herds. The males are always much larger than the females, and are polygamous. They are now usually grouped in one genus (*Otaria*), though formerly broken up into several genera. Of the Sea-lions, sometimes called Hair-seals to distinguish them from the Sea-bears or Fur-seals, the best-known and the largest is the Northern Sea-lion (*O. stelleri*) from the North Pacific. The Patagonian Sea-lion (*O. jubata*) was first brought alive to Europe in 1866. A French sailor named Lecomte secured a specimen and sold it to the Zoological Society. When this animal died, Lecomte went out to the Falkland Islands for other specimens, one only of which arrived safely. This animal exhibited great docility and intelligence, and was taught some amusing tricks by its keeper. The Californian Sea-lion (*O. californiana*) has frequently been brought to Europe. The Fur-seal or Common Sea-bear of the North Pacific (*O. ursina*) has its chief home in the Prybiloff Islands, where it breeds. The adult male is from 6 to 7 feet long, and the female about 4 feet. The breeding-places are known as "rookeries;" the "bulls" come on shore about the end of May or the beginning of June, and the mating commences as soon as the females arrive, each bull securing as many mates as he can. By the middle of September the young have learned to swim, and the rookery is deserted till the following breeding season. The Prybiloff Islands were acquired by America from Russia in 1870, and the assumption of sovereign rights over the Behring Sea by the United States Government gave rise to complications with this country, which were settled by the Convention of 1893. By this convention the take of seals was regulated; but killing in open sea prevails to such an extent that it is probable that in the near future the northern Fur-seal will be as scarce as its southern congener (*O. pusilla*), the Cape Fur-seal, which is said to be on the verge of extinction. The True Seals constitute the family *Phocidæ*, and are much more aquatic than the Eared Seals. On land their hind-limbs afford them no assistance, and their progression is a series of jumps, aided in some cases, to a small extent, by the fore-limbs. The Common Seal (*Phoca vitulina*) is found on the European and American shores of the Atlantic and in the North Pacific. Round the British and Irish coasts it is fairly common "in all suitable localities, from which it has not been driven away by the molestations of man." The usual length is from 4 to 5 feet; greyish-yellow in colour, with dark spots, on the upper surface, and lighter below. To the same genus belong the Harp Seal (*P. grænlantica*), the Ringed Seal (*P. hispida*), the Bearded Seal (*P. barbata*), and the Seals of the Caspian and Aral Sea (*P. caspica*) and Lake Baikal (*P. sibirica*). Most of them are hunted for the sake of their skins, blubber (which yields a valuable oil), and flesh. Sir W. Flower puts the take of Greenland Seals by the Scotch, Dutch, and Norwegian sealing vessels at 200,000 annually. The Grey Seal (*Haliæchærus grypus*), larger than the Common Seal, seems

to be confined to the North Atlantic, and occurs on the British coasts. The Danes are trying to exterminate this species on account of the harm it does to their fisheries. The Monk Seals (*Monachus*) inhabit the warmer seas. One species (*M. albi-venter*) is Mediterranean, and *M. tropicalis* West Indian. The Common Sea-leopard (*Ogmorhinus leptonyx*) and Weddell's Sea-leopard (*Pæcilocphoca weddelli*) inhabit southern temperate seas and the antarctic regions. The Hooded or Bladder-nosed Seal (*Cystophora cristata*), a native of the Polar seas, is remarkable for a dilatable sac on the face of the male, which can be inflated at will, and then extends backwards, covering the upper part of the head. The Elephant Seal (*Macrorhinus leoninus*), from southern seas and the coast of California, is the largest of the family, adult males being nearly 20 feet in length, while the females are much smaller. In other genera there is little difference in the sexes in point of size. The full-grown males have the snout produced into a kind of trunk, which can be dilated and extended at pleasure. This animal is hunted for its blubber and skin.

Sealing-Wax does not now contain any wax, as its name would imply. Coarse varieties are made from resins coloured by the thorough incorporation with the melted material of red-lead, vermilion, or other pigment according to the colour desired, the sealing-wax being cast in moulds and allowed to cool. The better varieties contain shellac in place of the resin.

Sea-Lion. [SEAL.]

Search Warrant, an authority granted upon information or complaint made in writing and upon oath, empowering the person to whom it is addressed to search a house or other place therein specified, against anyone suspected of treason, felony, or any indictable misdemeanour, or to search for stolen goods. When the warrant is received by the officer, he is bound to execute it in any place to which the jurisdiction of the magistrate and himself extends, and he may break open doors in order to execute it. (See the Larceny Act, 24 and 25 Vict. c. 96.)

Sea-Serpent. The idea that a gigantic marine serpentiform animal exists appears in the works of old naturalists, but with such manifest exaggerations that their accounts of it may be dismissed as throwing little or no light on the subject. There is, moreover, little doubt that some of the appearances which have given rise to sea-serpent stories have been due to schools of porpoises at play, floating weed rising and falling with the waves, or flocks of sea-birds, all of which may convey the impression of undulatory or serpentine motion. But accounts have been given by persons who claim to have had a view of the sea-serpent at close quarters, and these seem to establish the fact that the ocean depths contain gigantic creatures resembling, or presenting the appearance of, monstrous snakes. First in point of time comes the story of Captain McQuhae, of H.M.S. *Dædalus*, who, in his voyage home from the East Indies in 1848, sighted an enormous serpent with head and

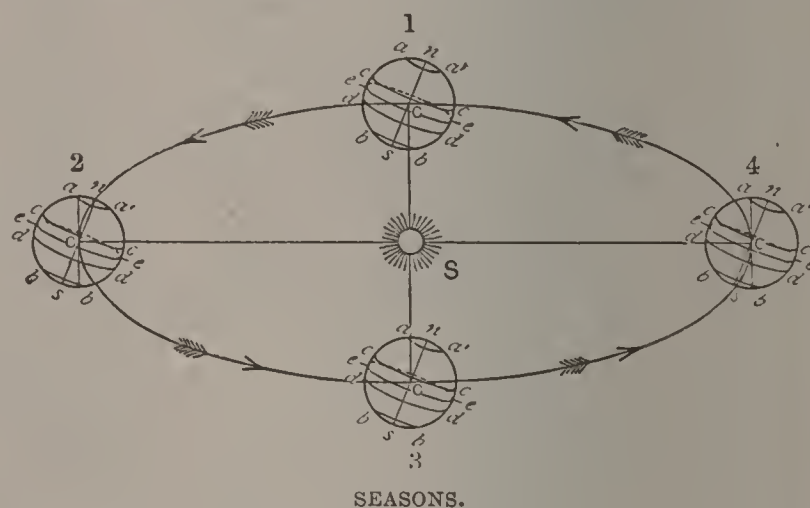
shoulders kept about 4 feet above the water, and there was about 60 feet of the creature visible, no part of which was used in propelling it through the water. The late Sir Richard Owen thought that the creature was an enormous seal, and a similar theory has been put forward more recently by a Dutch naturalist to account for all sea-serpent stories. Lieutenant Haynes, of the royal yacht *Osborne*, saw a sea-serpent off the coast of Sicily in 1877 (*Graphic*, June 30), and since then two or three other instances have been recorded. In September, 1893, Mr. Lydekker, when off the coast of Brazil, witnessed a finner whale attacked by killers (*Orca gladiator*), and apparently worrying the whale beneath the surface was what he took to be a "gigantic shark, allied to the thresher, but of a white colour, and probably armed with much larger teeth." He adds, "If so, we have evidence of a fish at present unknown to science." (*Natural Science*, March 1894.) What the sea-serpent is cannot be decided without further evidence. There is, however, no doubt that the belief in gigantic marine monsters has a basis of fact to rest on.

Sea-Sickness. The symptoms of this malady are headache, giddiness, vomiting, and prostration. The transformation from the enjoyment of perfect health to a condition of absolute dejection, and the usually equally rapid recovery, which are the phenomena presented by sufferers from this disease during, and after, a short sea passage, constitute a remarkable sequence of events, and it is not a little astonishing that the movements of the vessel, which produce such a profound impression upon those who are susceptible to sea-sickness, should cause no discomfort whatever to certain fortunate persons. During long voyages, when vomiting repeatedly occurs, a condition of collapse supervenes which has in rare instances proved fatal. On the other hand, some persons under similar circumstances only suffer discomfort for a short period, a state of tolerance of the unusual conditions becoming established. Numerous theories professing to explain the cause of sea-sickness have been formulated. One of the most probable views enunciated is that which attributes the symptoms to the disturbance set up in the semicircular canals of the ear by the movement of the ship. These structures are supposed to be concerned with the notions entertained by the individual as to his space relationships, and abnormal impulses transmitted by them to the brain, and thence reflected along the gastric fibres of the vagus, may play an important part in the causation of the malady. As regards treatment, innumerable specifics have been recommended, a sure indication that no one of them is completely efficacious. Probably the best plan to adopt for those who are reluctantly compelled to undertake a short voyage is to eat a good meal three or four hours before embarking, and to lie down or sit still while on board. If it is possible to remain on deck and near the centre of the vessel so much the better. A mixture of chloral and bromide of ammonium, administered half an hour before the vessel starts with a view to securing sleep, has been recommended. In serious cases,

with persistent vomiting, this remedy may be employed, and if collapse is extreme, stimulants must be administered, and medical advice procured. The use of a tightly-applied abdominal belt, or of an icebag to the spine, has been advocated, and the latter method has, it is said, produced good results in prolonged cases.

Sea-Snake, any snake of the family Hydrophidæ, from the Indian and Australian seas. The body is flattened, and the tail acts as a swimming organ and rudder. These snakes, some of which attain a considerable size, are intensely venomous, and feed chiefly on fish. When cast on shore, they are helpless and nearly blind.

Seasons. If the earth were to rotate about an axis perpendicular to the plane of her path round the sun, at any position which she might occupy the whole of one hemisphere stretching from pole to pole would remain for twelve hours under the sun's influence, and would be turned away to the darkness of space for the other twelve hours.



Every day would be exactly like every other day; the equator would always be the hottest portion of the earth, since it would always have the sun vertically overhead; and the poles would always be the coldest spots, as they would receive the most oblique rays. But the axis of the earth's rotation is not perpendicular to the plane of her orbit (the ecliptic), but makes an angle with it of $66\frac{1}{2}^{\circ}$ and remains pointing in the same direction, or parallel to itself, all through the year. The above diagram may be taken to illustrate the position of the earth on March 21st, June 21st, September 23rd, and December 21st. In position 1 the radius $s c$ of the earth's orbit is perpendicular to the axis, $n s$. Light from the sun then falls vertically upon the equator, $e c$, and every spot on the earth enjoys equal day and night. This is the vernal equinox. In position 2 the line $s c$ is perpendicular not to $n s$ but to $a b$, a line inclined at an angle of $23\frac{1}{2}^{\circ}$ to $n s$, and the sun is not vertically above the equator, but is over $e c$, the Tropic of Cancer, a circle parallel to the equator and $23\frac{1}{2}^{\circ}$ north of it. Every point in the northern hemisphere is now having a day more than twelve hours long, is receiving more heat from the sun, and the summer season is in progress. If a circle, $a a'$, be drawn $23\frac{1}{2}^{\circ}$ from the pole n , it will be seen that no point north of this circle is ever in darkness, since every

point rotates about the line ns . At the summer solstice, therefore, there is perpetual day within the arctic circle, as $a a'$ is called. It is to be remembered that the sun is so far away that his rays light up a complete hemisphere, the external rays touching the earth round the circle ab . In position 3 the sun is again vertical to the equator, equal day and night prevail everywhere, and the earth is at the autumnal equinox. Position 4 represents the earth at the winter solstice, when we have the conditions of 2 reversed. What was then true of the northern hemisphere is now true of the southern, and *vice versa*. sc is perpendicular to ab , but every point in the arctic circle is now in permanent darkness, while in the symmetrically-placed antarctic circle, $b b'$, there is perpetual day. The sun is vertical to $d d'$, the Tropic of Capricorn, $23\frac{1}{2}^\circ$ south of the equator. In the northern hemisphere, then, the rays are as oblique as possible, the least amount of heat is received, the nights are longest, and it is winter. It might be thought that since the sun reaches its most northern limit on June 21st, the longest day, that that day would also be the hottest; but this is not so. For some time after this day the earth (in the northern hemisphere) is receiving more heat during the day than it loses during the night; there is, therefore, a gain of heat during each twenty-four hours, although the gain itself gets gradually less. Hence it is hotter in the months of July and August than in June. It is to be remembered also that the earth moves, not in a circle, but in an ellipse with the sun in one focus; at one part of the year, therefore, the earth is nearer the sun (in perihelion) and is moving fastest, while at another part it is in aphelion and is moving most slowly. The latter occurs during our summer, so that this is longer to the extent of about eight days than our winter. Being then farther away from the sun, summer in the northern hemisphere is less extreme than in the southern. This tends to make both summer and winter more temperate in the northern than in the southern half of the world.

Seattle, the capital of King county, Washington Territory, U.S.A., stands on a bay of the same name on the E. shore of Puget Sound, between Lakes Union and Washington, with which it is connected by canal. It possesses ship-yards, saw-mills, foundries, and factories of various kinds. It is also the seat of the university of the Territory.

Sea-urchin, the common name for the members of the class Echinoidea (q.v.).

Seaweeds. [ALGÆ.]

Sebaceous Gland. Sebaceous glands are met with in most parts of the skin, being very numerous in situations where there is abundant growth of hair, but entirely absent from the palms of the hand and soles of the feet. They secrete a soft ointment-like substance and usually discharge into a hair follicle, the secretion serving to lubricate the hair. Cysts sometimes develop in association with the blocking of the orifice of a sebaceous gland. These *sebaceous cysts* are frequently met with in the scalp.

Sebastian, St., was born at Narbonne, in

France, in the 3rd century A.D. His parents were Christians, and, after being educated at Milan, and being made a captain of the prætorian guard, he became a zealous missionary, which led to his condemnation by Diocletian, Emperor of Rome, who ordered him to be shot with arrows. He miraculously recovered, and interceded with the tyrant for the Christians, and was then martyred, and his body thrown into a sewer, whence it was obtained and buried in the catacombs of Rome. His festival is January 20th.

Sebastiani, FRANÇOIS HORACE BASTIEN, COUNT (1772-1851), was born in Corsica, and claimed connection with the first Napoleon. He distinguished himself greatly in the latter's Italian wars, and was at Ancona, Verona, and Marengo, as well as at Austerlitz, and served throughout the Peninsular War. He was a good diplomatist, and was ambassador to England in 1835. In 1830 he was a French minister, and in 1840 was made Marshal of France.

Sebastiano del Piombo (1485-1547), Italian painter, was born at Venice, whence he was sometimes called VENEZIANO. He first studied music, but afterwards turned to painting, studying under the painters Bellini and Giorgione. The last-named he equalled in imitating him. He went to Rome in later life, and made the acquaintance of Michelangelo, who persuaded him to paint the fine *Resurrection of Lazarus* now in the National Gallery of London.

Sebastopol or SEVASTOPOL, the chief naval port and arsenal of Russia, on the Black Sea, stands, at the S.W. extremity of the Crimea, on the S. shore of the estuary of the Tchernaya, which, with a length of nearly 4 miles and a breadth of over half a mile, affords secure anchorage for the largest vessels. In 1854 the siege, which lasted nearly a year and a half, reduced the city to a heap of ruins. By the Treaty of Paris terminating the Crimean War Russia was forbidden to restore the fortifications or to maintain a Black Sea fleet. These obligations, however, were repudiated in 1870, and now Sebastopol has almost recovered its former population and military importance.

Secker, THOMAS (1693-1768), Archbishop of Canterbury, was born in Notts, and received his education at Leyden and Oxford. Taking holy orders, he was made Bishop of Bristol in 1735, Bishop of Oxford in 1737, and appointed to the see of Canterbury in 1758. He was a man of great learning, and his Charges and other addresses are very eloquent and cogent.

Second is one-sixtieth part of a minute, and is the unit of time universally adopted. It is fundamentally derived from the time which elapses between two successive transits of a star, this being the time taken by the earth to exactly complete one revolution on its axis, and being known as one sidereal day. The length of a pendulum which beats seconds varies in different places, owing to the variations of gravity. Hence, if the standard of length were lost, it could always be reconstructed. [PENDULUM.] A second is also used as a measure

of angles, it being one-sixtieth part of one angular minute, which is, again, one-sixtieth of a degree.

Secondary Batteries, ACCUMULATORS, or STORAGE CELLS. When an electric current is passed from one metallic plate to another through an electrolyte, the electrodes are polarised [POLARISATION], and, by suitably arranging matters, a considerable amount of energy may be stored up in this polarisation and subsequently be available as an electric current. In Planté's original secondary cell two large sheets of lead were immersed in dilute sulphuric acid; on connecting these to a source of electric current, the anode becomes covered with a film of lead peroxide, while hydrogen reduces any oxide which may be present on the cathode. If now the plates are disconnected from the charging dynamo or battery, they will be found to differ in potential by rather more than 2 volts, and, if connected, will give a current which is in the reverse direction to the charging current. In discharging, the peroxide plate is reduced and the lead plate is oxidised. Such a cell has a very small capacity, which may be largely increased by repeated charging and discharging, the polarity of the plates being reversed between each operation. This process of *forming* reduces the surface of the plates to a spongy condition, whereby their active area is much increased. In order to effect the same result more easily, Faure coated the plates with red-lead, held in place by felt, which was packed between them, and which was converted by the forming process into lead peroxide on one plate and spongy lead on the other. An improvement on this plan was to cast the plates in the form of grids with many small holes, and to fill these with a paste of lead oxide and sulphuric acid. Many methods have also been devised for making spongy lead plates, the result to be aimed at in either case being a plate exposing a very large area of active material to the electrolyte. The chemical reactions which occur in secondary cells are of an exceedingly complicated character, and have been much discussed, but the subject is too extensive to be entered upon here. Commercial accumulators usually consist of a number of plates alternatively positive and negative placed in glass boxes, suitable arrangements being made for connecting similar and insulating dissimilar plates. Such cells have important applications in electric lighting; in private installations the machinery may be run, say, one day in seven, as much energy being then stored as is needed during the week. In supplying electricity from central stations, the demand is practically confined to a few hours in the twenty-four, so that much less plant is needed if the machinery is run continuously, and the energy stored in accumulators for use when required; but, owing to the initial cost and maintenance of, and losses in, secondary batteries, it is as yet doubtful if any real economy is attained by this means. When in good order, the current efficiency of storage cells (that is, the ratio of ampère hours of discharge to ampère hours of charge) is about 0·85; but, as the charging pressure must always be in excess of the discharging pressure, the

watt efficiency is only about 0·75. Accumulators are also used for the propulsion of electric launches, and have been often tried for street railways, but with doubtful success in the latter case. Some other forms of secondary cells, which are practically reversed primary cells—such as Daniells (q.v.)—have been proposed, but are of small practical importance.

Secondary Rocks. [MESOZOIC.]

Second Sight, the name given to the power of foreseeing events which was formerly believed to be no uncommon attainment in the Scottish Highlands. The most awful vision was the "wraith" or "fetch" (*i.e.* the shadowy image) of a person about to die. The reputed seers were commonly men of stern and upright character, who through their elevation above the things of sense were supposed to have acquired peculiar insight into the spiritual world. But second sight was not confined to events of a solemn nature; it frequently gave intelligence of the most ordinary occurrences of every-day life. A full description of all its varieties, given in Martin's *Description of the Western Isles of Scotland* (1703), is reproduced in a shorter form in Defoe's *Life and Adventures of Duncan Campbell* (1720). Numerous modern cases have recently been investigated by the Society for Psychical Research.

Secretary Bird (*Serpentarius reptilivorus*), a South African bird of prey, the sole species of its genus, by some ranked with the Falcons and by others made a distinct family. The total length is about 3 feet; the general hue of the plumage bluish-grey, with some black on the wings and tail.



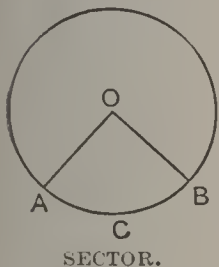
SECRETARY BIRD (*Serpentarius reptilivorus*).

On the head is an erectile crest, which, from its fancied resemblance to pens stuck behind the ear, is said to have given the bird its popular name. The Secretary Bird preys upon venomous serpents, and on this account is protected at the Cape, and for the same reason has been introduced into Guadaloupe and Martinique.

Secretion, the process of separation from the blood, by certain organs of the body, of materials which serve some further purpose in the performance of the functions of the animal economy, or are

discharged from the body as being of no more use to it. The latter kind of material is sometimes spoken of as *excretion*, as distinguished from a true *secretion* which has some further part to play in connection with the body in which it is elaborated. (For *Secreting glands*, see GLANDS.)

Sector is the space included between two radii of a circle and the intercepted portion of the circumference. O A C B represents such a sector, and its area is equal to that of a triangle, whose base is a straight line equal to the curved line A C B, and whose height is equal to the radius O A.



Secularism (*seculum*, "the present world"), a view of man's social duties propounded and named by Mr. George Jacob Holyoake (q.v.) about 1846. Secularists maintain that the *summum bonum*—that which is most desirable for mankind at large—is sufficiently known from experience, and that, as vice results merely from error, it needs only an adequate training to make every citizen exert himself successfully for the benefit of his fellow-creatures. Theology and religion cramp and distort the mind by introducing considerations which have no real bearing on the relation of man to his surroundings in this present life, the only one of which we have any knowledge. The true ethical ideal, according to this school, is the wise employment of material agencies for the good of the community, and the existence or non-existence of a Divine Being is a matter of no importance at all.

Security, some bond or other act which makes the enjoyment or enforcement of a right more secure or certain. It is either *personal*, consisting of a promise or obligation by the debtor or another person, in addition to the original liability or obligation intended to be secured, or a *security on property* by virtue of which the enforcement of a liability or promise is facilitated and made more effectual.

Sedan, a town in the Ardennes, France, standing on the right bank of the Meuse, 13 miles E. of Mezières, and surrounded by hills. It was not definitely acquired by France until 1643, and then became a frontier fortress. Here on September 1, 1870, Napoleon III., with an army of over 80,000 men, was hemmed in by the Germans and forced to surrender. Cloth-making is a flourishing industry, and there are several cotton-mills and iron-foundries.

Sedan Chair, a covered chair for carrying a single person, with a pole on each side. It is borne by two men, one in front of the chair and the other behind it. The vehicle is said to have been invented at Sedan in N.E. France. It made its appearance in England in 1581, and was used by the Duke of Buckingham in the reign of James I. In 1634 Sir Sanders Duncombe obtained a patent for letting out these "covered chairs" in the cities of London and Westminster. Sedan chairs were much used by fashionable ladies and gentlemen in the 18th century.

Sedative, the term applied to a class of remedies which exercise a restraining action on

certain of the animal tissues. For example, *respiratory* sedatives prevent spasm of the muscular tissue of the bronchi, and so relieve cough. *Cerebral* sedatives, such as the bromides, diminish excitability and over-activity of the central nervous system. *Cardiac* sedatives comprise the drugs which exercise a restraining influence on the nervo-muscular apparatus of the heart, and *intestinal* sedatives tend to arrest the muscular movements of the bowel.

Sedge, a name applied to most members of the order Cyperaceæ, and especially to the genus *Carex*. The order includes about 120 genera and 2,000 species, most abundantly represented in temperate and cold regions. It belongs to the Series Glumiferae, of the Sub-class Nudifloræ, among Monocotyledons, and consists of grass-like herbaceous plants, which have generally solid, jointed stems, often three-sided; leaves, tristichous and furnished with a tubular sheath (not split, as in grasses); and spikelets of reduced, and often unisexual, flowers, each in the axil of a glume. The perianth is only represented by a whorl of hairs or by adherent glumes forming the so-called *utricle* in some pistillate flowers. The stamens, though varying from one to twelve, are usually three, and have basifixed anthers. The ovary is syncarpous, of two or, more commonly, three carpels, with a style divided above, and one ovule. The embryo is at the base of the seed, but is surrounded by albumen. Several species, such as *Carex arenaria*, are valuable, as binding shifting sand with their creeping rhizomes; others, such as the bulrush, *Scirpus lacustris*, are used for chair-bottoms, mats, etc.; the long perianth-hairs of the so-called "cotton-grass," *Eriophorum*, are used, under the name of "Arctic wool," to stuff cushions; and *Papyrus antiquorum*, formerly abundant in the Nile, yielded the papyrus or paper of the ancients. The foliage is, as a rule, too harsh for fodder, and the albumen of their seeds does not improve or increase noticeably under cultivation.

Sedgemoor, a marshy district in the middle of Somersetshire, 5 miles S.E. of Bridgwater. Here in 1685 the rebels under the Duke of Monmouth were defeated by the troops of James II. under Lord Faversham.

Sedgwick, ADAM (1784-1873), geologist, was born in Yorkshire, and became a graduate of Cambridge, Fellow of Trinity, and Canon of Norwich. He took a keen interest in geological science, and did not a little to popularise it. In 1818 he became professor of it at Cambridge, and began to collect specimens, which have helped to make the Woodwardian Museum at that university one of the best of its kind in Europe. He discovered some very valuable formations, and contributed many important papers to the *Transactions of the Cambridge Philosophical Society* and those of the Geological Society.

Sedley, SIR CHARLES (1639-1701), English poet and wit, was the son of Sir John Sedley, and was born in Kent. After leaving Oxford, he travelled abroad, returning after the Restoration, and becoming a bosom friend of Charles II., whom he

even excelled in recklessness. On one occasion he was fined £500 for a wild orgie in Covent Garden. In 1661 he became M.P. for Romney, and was a determined opponent of King James. He was a man of wit, and wrote some very graceful songs. His poetry has often been reprinted.

Seed, the fertilised ovule or macrosporocarp of Spermatophyta (Phanerogamia), of which it constitutes the most distinctive structure. It is a peculiar modification of a structure occurring in lower plants (Pteridophyta), which encloses a macrospore (embryo-sac) with its embryo and albumen, and becomes, when ripe, detached from the sporophyte. Its seed-coats or integuments being an outgrowth from the parent sporophyte, the embryo-sac being an oophyte, and the embryo an immature sporophyte, the seed contains structures belonging to three generations. When the structural and other changes that immediately follow fertilisation are complete, and the seed becomes "ripe," it enters upon what is generally the most marked period of unchanging repose in the life-history of the plant, a period which may be of the most varied duration before germination begins. The typical seed consists of integument, embryo (q.v.), and albumen (q.v.). The integument may consist of one coat or *testa*, or there may be an inner one, the *tegmen*. The *testa* may be smooth, as in the bean or the horse-chestnut, where it is marked by a large scar or *hilum* at its point of attachment, or it may bear wrinkles or tubercles, wings or hairs. The seeds of firs and toadflax *e.g.* are winged; cotton (q.v.) is the hairs on the *testa* of *Gossypium*; and willows have a similar tuft of hairs or *coma*. Such wings and tufts occur only on the seeds of dehiscent fruits, serving, as do the similar structures on the fruits themselves, to disperse the seed beyond the shadow of the parent. The *testa* is usually thick, leathery, opaque, impermeable, bitter and indigestible, and is more often brown than any other colour. It serves to protect the contained embryo from premature germination by excluding damp, or from the action of sea-water, or the gastric juice of the animal stomach. The *testa* of linseed is mucilaginous, that of the gooseberry and pomegranate is pulpy, and that of the Brazil-nut exceptionally woody, whilst orchids have a *testa* reduced to one layer of transparent cells. Brightly-coloured *testas* are confined to dehiscent fruits, as are also the fleshy outgrowths from the *testa* known as *arils* (q.v.). When present, the *tegmen*, or *endopleura*, is usually a delicate, cream-coloured coat, as in the almond, hazel, or walnut. In a few seeds, no albumen is formed; but in the majority of exalbuminous seeds, though formed, it is absorbed by the embryo before the seed ripens. [GERMINATION.]

Seeley, SIR JOHN ROBERT (b. 1834), historian, was educated at University College, London, and at Cambridge, where he was Senior Classic and elected to a Fellowship at Christ's College in 1858. He became professor of Latin at University College, London, in 1863, and professor of modern history at Cambridge in 1869. His remarkable *Ecce Homo* (1865) and *Natural Religion* (1882) were published

anonymously, and caused much discussion. In 1871 he published his valuable edition of Livy, and, besides numerous learned historical articles, has written other admirable works. His *Expansion of England* (1883) has done much to promote a feeling for the unity of the Empire.

Segovia, a province and its capital in the N. of Spain, between the provinces of Burgos and Valladolid to N. and Madrid and Guadalajara to S. It has an area of 2,670 square miles, being for the most part a bare and lofty tableland. Large crops of wheat, however, are grown here, and the sheep yield fine wool. The rivers Eresma, Cega, Duraton, and Riaza, aided by careful irrigation, afford an ample supply of water. The capital, a poor place but full of Roman and Gotho-Mauresque antiquities, is placed on a rock above the Eresma, the Alcazar being at the extremity of the steep promontory. Trajan's aqueduct, the mediæval walls and towers, the cathedral (16th century), the churches of Vera Cruz, San Millan, and San Juan possess high interest. There are no industries except a little cloth-weaving, and the place is gradually decaying.

Ségur, LOUIS PHILIPPE, COUNT DE (1753–1830), French diplomatist and author, acted as ambassador in Berlin and Petersburg, and became an Academician. He was the son of a notable Marshal of France, the MARQUIS DE SÉGUR (1724–1801), who was Minister of War in 1780. Count de Ségur wrote some important historical works, but his *Memoirs* (1826) are perhaps more widely read. He is an authority on the Russian campaign.

Seidlitz Powder. The spring of Seidlitz, in Bohemia, furnishes a natural aperient water, the chief constituent of which is the double tartrate of soda and potash. The *pulvis sodæ tartaratae effervescens* of the Pharmacopœia consists of this drug, together with some bicarbonate of sodium contained in a blue paper, and some tartaric acid contained in a white paper. The two powders are mixed in about half a pint of water, carbonic acid is liberated, and the draught is taken during effervescence.

Seine. 1. The smallest, but most populous, department of France, has an area of 183 square miles, entirely surrounded by Seine-et-Oise, one-sixth being occupied by the city of Paris. The surface is mostly level, nowhere exceeding an elevation of 500 feet, and the soil is poor, but with artificial manure and spade-culture yields abundance of vegetables and fruit. The Marne, Bièvre, and Rouillon drain into the Seine within its limits. Besides the capital, it contains St. Denis, Sceaux, Montreuil, Vincennes, Boulogne, Pantin, Aubervilliers, Varves, Puteaux, Ivry, Clichy, and Choisy-le-Roi.

2. A river of France, rising in the plateau of Langres, Côte d'Or, eighteen miles N.W. of Dijon, and flowing, with a winding course of 482 miles, into the English Channel at Havre. It can be navigated by vessels of 20-feet draught to Rouen, and by barges as far as Bar, 395 miles from the mouth. Its chief tributaries are—on the right, the Aube, Marne, and Oise; on the left, the Yonne, Loing, Essene, and Eure.

Seine-Inférieure, a department of France, bounded N. and N.W. by the Channel, N.E. by Somme, S. by Eure and the mouth of the Seine, E. by Oise. The area of about 2,330 square miles is mostly a plateau sloping from the E., where it is 800 feet above sea-level, to the river and sea, where the cliffs are broken by eroded valleys. The hills of Caux divide the department, the southern half being made up chiefly of pastures and forests, whilst arable farms prevail in the N. Industries flourish, for Rouen is the Manchester and Elbeuf the Leeds of France, and there are engineering works at Havre and Rouen, tobacco factories at Dieppe, whilst sugar, flaxen yarn, lace, glass, and other manufactures are produced at other places.

Seine-et-Marne, a department of France, bounded N. by Oise and Aisne, E. by Marne and Aube, S. by Yonne and Loiret, and W. by Seine-et-Oise, and having an area of 2,215 square miles, lying wholly within the basin of the Seine. The surface falls gently in a series of tablelands from E. to W., and the soil is for the most part good, the pastures of the Brie producing famous cheeses, whilst the southern portion is noted for the *Chasselas* grapes. The forests, including that of Fontainebleau, cover a fifth of the department, and yield valuable timber. Among the chief industries are paper-making, pottery, sugar-refining, and the manufacture of bread-stuffs. Melun is the capital, Fontainebleau, Meaux, and Provins being towns of importance.

Seine-et-Oise, a department of France, bounded E. by Seine-et-Marne, W. by Eure-et-Loire, S. by Loiret, and N. and N.W. by Oise and Eure. It encloses the department of Seine, and has an area of 2,160 square miles, most of which is arable land, though there are extensive woods about Versailles and St. Germain, many vineyards towards the S., and good pastures, including part of Brie. The famous corn-growing plateau of La Beauce extends into the W. portion. Building-stone, plaster, and potter's clay are the only mineral resources. The factories for porcelain at Sèvres, powder at Sevran and Bouchôt, paper at Essonne, Corbeil, and Étampes, iron-founding at Corbeil and Argenteuil, employ many hands, and there are large cotton- and silk-mills, sugar-refineries, etc. Versailles is the capital, and, besides the above-named, Pontoise, Mantes, Enghien, and Rambouillet are important centres.

Seismograph is an instrument for recording movements of the earth's surface which, if sufficiently pronounced, become earthquakes. These motions are of two kinds—quick vibrations and slow tiltings of the surface. For measuring the quick tremors, a heavy body is suspended in such a way that it has freedom of motion in one or more directions, and is in a condition of nearly neutral equilibrium—that is to say, if it is displaced, it has hardly any tendency to return to its original position. A body so suspended would remain stationary, or nearly so, when its supports moved in consequence of earth-tremors, and the relative

motions of the body and its supports would be a measure of the extent of the motion of the ground. A very long pendulum fulfils the conditions as regards horizontal motions; but a more convenient arrangement, due to Ewing, consists of two pendulums, one of which is inverted and placed vertically below the other. The two bobs are connected by a ball joint. The combination of the stability of the upper pendulum with the instability of the lower one can give the required neutral equilibrium. A point, connected with the lobes by multiplying levers, records the motion on a plate of smoked glass. By allowing the pendulums to swing freely in any direction, a complete record of the horizontal tremors is obtained, while the motions in any given direction may be observed by giving the pendulum freedom in that direction only. By the latter means the horizontal vibrations may be resolved into two components at right angles, and recorded on a disc of smoked glass rotated by clockwork; from the diagram so obtained the motion at any moment can be ascertained. An instrument for measuring vertical tremors may be constructed on the same principle. In Ewing's arrangement a horizontal lever, pivoted at one end and weighted at the other, is supported by a spiral spring, the position of the point of attachment being so arranged that the necessary neutral equilibrium is obtained. A style moved by multiplying levers is provided to make a record on smoked glass. These instruments would not be affected by a slow alteration of level of the earth's surface, for the measurement of which other appliances are needed. The simplest arrangement is to place two spirit levels on the spot to be observed, and to watch their bubbles with microscopes. A better way is to observe the relative motion of two beams of light emanating from the same source, one being reflected from the surface of mercury, which is horizontal, and one from a mirror attached to the rock whose motion is to be observed.

Selaginella. [CLUB-MOSSES.]

Selborne, ROUNDELL PALMER, EARL OF (b. 1812), lawyer, was born in Oxfordshire, and, after taking his degree at Oxford, was called to the bar in 1837. He soon acquired a practice, and in 1847 entered Parliament as Liberal M.P. for Plymouth, which seat he held till 1857. In 1861 he was appointed Solicitor-General and in 1863 Attorney-General. He was strongly opposed to the disendowment of the Irish Church, and both wrote and spoke forcibly against it. He became Lord Chancellor in 1872, and again in 1880. He received an earldom in 1882, and became a Liberal Unionist in 1886. He has published several works on Church history and ceremonial.

Selborne Society, incorporated 1888, with the object of preserving harmless wild animals and plants, and promoting the study of natural history.

Selden, JOHN (1584–1654), English jurist and antiquary, was born in Sussex and was educated at Chichester and Oxford. He entered the Temple and was called to the bar, practising with much success, and making at the same time deep

researches into English legal history. In 1607 he published his *Analeetum Anglo-Britannicum*, which was followed by others, especially his *Titles of Honour* (1614) and his *History of Tithes*, which last he had to apologise for. In 1623 he became M.P. for Lancaster, espousing the popular side. His *Mare Clausum* (1635) upholds the right of the English to certain marine territory. In 1640 he published *De Jure Naturali*. By this time he was justly celebrated as one of the greatest men of his age, and in 1643 he was appointed Keeper of the Records in the Tower. He was very popular, and in 1644 the Government voted him £5,000 for his public services. His *Table Talk*, an interesting work, appeared thirty-five years after his death.

Selection, NATURAL. [DARWINISM.]

Selenic Acid. [SELENIUM.]

Selenides. [SELENIUM.]

Selenite, the translucent crystalline variety of gypsum (q.v.), so named from the resemblance of its pearly lustre to moonlight. It crystallises in the Oblique system, often in flat rhomboid forms, and is in swallow-tailed twins. The crystals are sometimes large, very symmetrical, and laminated parallel to the largest faces, and they may be bent. They are 2 in the scale of hardness. Selenite forms rapidly on the surface of clay from the decomposition of iron pyrites and calcareous fossils in moist air.

Selenium (SE, 78.9), a rare non-metallic element, occurs to a small extent in certain iron pyrites, and, owing to its presence in this source, sometimes in deposits in the lead chambers used in the manufacture of sulphuric acid (q.v.). It was in these deposits that the element was first discovered by Berzelius in 1817. In most of its chemical properties selenium resembles sulphur, and is capable of existing in two allotropic forms. One of these is obtained as a reddish-brown powder by the reduction of the oxide of selenium, and is soluble in carbon disulphide. If melted and kept molten for some time, being allowed to cool very slowly, a crystalline variety is obtained. This form is insoluble in carbon disulphide, has a specific gravity of 4.6, and melts at 217° C. If strongly heated in air selenium burns, forming a dioxide SeO_2 , with a strong and peculiar odour. This oxide condenses to form needle-shaped crystals, and dissolves in water to form selenious acid, from which, by oxidation, a powerful acid (*selenic acid*) results. This acid is remarkable as being the only single acid which is capable of dissolving gold. It forms salts, known as the *selenates*, which in most points closely resemble the sulphates. With hydrogen, selenium forms a compound, SeH_2 , which is a combustible colourless gas, with a most penetrating and disagreeable odour, powerfully attacking the throat and eyes. It is easily soluble, and resembles the corresponding sulphur compound, producing, in solution of most metallic salts, precipitates of metallic *selenides*. It was so-called from *selene*, "the moon," because in many respects it resembled tellurium (from *tellus*, "the earth").

Selenodont. [BUNODONT.]

Seleucia (Greek *Seleukeia*), the name of several ancient towns which owed their origin to the Seleucidæ. One of these, founded by Seleucus I. on the Tigris, became the capital of Syria, and attained great splendour, of which no trace remains but a few ruins near Bagdad. Seleucia Pieria, another city of the same date, stood near the mouth of the Orontes, and was the port of Antioch, forming a member of the Syrian Tetrapolis.

Seleucus, founder of the Macedonian dynasty of the Seleucidæ, was born about 358 B.C., and was surnamed Nicator or "the Conqueror." He was a notable warrior under Alexander the Great, and served in Persia and India. Becoming satrap of Babylonia in 322, he fell into difficulties, which led to his flight into Egypt, whence he returned in 312, and, recovering Babylonia, he took the title of king. He obtained enormous power, founded Antioch, Seleucia, and other cities, and gained great victories over Demetrius (286), and over Lysimachus (281). He was assassinated in 280.

Self-Induction, in electricity, is a property of electric circuits which causes electricity in some cases to apparently possess inertia. When an electromotive force is applied to a circuit, a magnetic field has to be created, and work must be done. This results in a back electromotive force, which, as it were, draws back the current, so that it only rises gradually to its steady value. The reverse effect occurs on breaking the circuit, as the lines of force, in closing up, generate an electromotive force which tends to keep the current flowing for a short time. Self-induction has an important effect on the action of alternate current apparatus. [ELECTRICITY.]

Selim III. (1761–1808), Sultan of Turkey, was the son of Mustafa III., and when he ascended the throne in 1789 great expectations were raised from his known admirable qualities. He was, however, hampered by the Janissaries, who defeated his efforts at reform, and finally deposed him in favour of Mustafa IV., who caused him to be strangled. He had contracted alliances with the English and French at different times, and on Napoleon's successful invasion of Egypt it was the former who restored it to him.

Selkirk, a county, and its chief town in the Lowlands of Scotland. The former is of straggling shape, and is bounded N. by Midlothian, N. and W. by Peebles, S. by Dumfries, and E. by Roxburgh, having an area of 260 square miles. Most of the surface is mountainous, but along the courses of the Ettrick, the Yarrow, and the Upper Tweed, tracts of arable land extend. Many lakes are scattered over the surface, all of them of moderate size. The mineral resources are restricted to building-stone, and the woollen fabrics of Galashiels are the chief manufacture. The capital is a small but fairly prosperous town on the Ettrick. Its antiquity is very great, and a royal castle existed here in the twelfth century, but nothing but a mound is left to show its site. There are large mills for woollen goods, and the market does a good trade in local produce.

Seltzer Water is a natural water which contains, together with certain quantities of mineral salts (*e.g.* chloride of sodium and sulphate of magnesia), a large amount of dissolved carbonic acid gas, which gives it its sparkling properties. A water somewhat resembling the natural water may be prepared artificially by dissolving the salts in water and impregnating with carbonic acid gas under pressure, as in the various arrangements for the purpose sold under the names of *seltzogenes*, etc.

Selwyn, GEORGE AUGUSTUS (1809–78), first Bishop of New Zealand, was the son of an eminent lawyer, was educated at Eton and Cambridge, and ordained curate of Windsor in 1833. In 1841, when the episcopacy was extended to the colonies, he obtained the see of New Zealand, and worked there most arduously and successfully, so that in 1867 his colony was subdivided into seven dioceses. He soon after became Bishop of Lichfield. His *Verbal Analysis of the Holy Bible* appeared in 1855, and several volumes of his sermons have also been published. A biography of him came out in 1879.

Seminoles, North American aborigines, a branch of the Muskogean family (*q.v.*), formerly numerous and powerful in Florida and neighbouring districts, but in 1890 reduced to 2,539, of whom 200 still survived in Southern Florida, while all the rest had been removed to the Union Agency, Indian Territory. The Seminoles do not appear to have been the primitive inhabitants of Florida, which was first held by Timuquanan tribes; but after the expulsion of the Apalachi by the English in 1702–8, the Seminoles, with the kindred Yamasi, were the only natives in occupation of the peninsula. Here they were gradually compelled by the progress of white settlement to give up agriculture and take refuge in the watery district of the Everglades, where they lived by the chase and fishing till removed to the Indian Territory.

Semiramis, Queen of Assyria, reigned four generations before Nitocris, according to Herodotus, but she was probably a mythical personage. Diodorus of Sicily tells a remarkable story of her being deserted whilst a child by her mother, a goddess, and kept alive by doves. She is supposed to have founded, with her husband Ninus, Nineveh and other cities and monuments, and to have lived 2,000 years before the Christian era.

Semitic Languages, a conventional name given by Eichhorn to a linguistic family, which Renan calls the *Syro-Arabic*, from the extreme northern and southern members of the group. There are four well-defined branches: (1) ASSYRIAN of the cuneiform writings, extinct probably before the new era; (2) ARAMAIC, comprising the *Syriac* of Syria and parts of Palestine, extinct since the 9th or 10th century of the new era, and the *Chaldean*, still spoken by a few Nestorians (*q.v.*) and other religious communities in Mesopotamia and West Persia; (3) CANAANITISH, comprising the *Phœnician* of the Palestine and south-west Mediterranean (*Punic*) coast-lands, everywhere extinct probably since the 5th century of the new era, and the *Hebrew* of the Israelites and Jews, which as a

vernacular rapidly merged in the Aramaic after the Babylonian Captivity; (4) ARABIC, comprising the *Arabic proper* of the greater part of Arabia, the language of the Koran, now current throughout the whole of Arabia, Mesopotamia, Syria, Palestine, Egypt, and most of North Africa, and *Himyaritic* of South-West Arabia (Yemen) and Abyssinia, all but extinct in Arabia, but surviving in more or less corrupt forms (*Tigriña*, Amharic, Harari, etc.) in Abyssinia. [GEEZ.] Although recent research has gone far to prove the original unity of Semitic and Hamitic speech [HAMITIC LANGUAGES], the relations are so slight, and go back to such a remote epoch, that Semitic must practically be regarded as an independent form of speech, belonging to the inflecting order, but fundamentally distinct from all other inflecting languages. It is distinguished, as might be expected from the mental temperament of the Semitic race (*q.v.*), by great stability and persistence; so much so that the various branches may almost be regarded as little more than dialects of a long extinct Semitic mother-tongue. Certainly these branches differ far less from each other—Hebrew, for instance, from Syriac, or Assyrian from Arabic—than do many members of the different Aryan branches from each other—English, for instance, from Old High German in the Teutonic, or Hindi from Sanskrit in the Indic branch. “On comparing the Chaldean of the fragments of Esdras, representing the Aramaic of the 5th century B.C., with the Syriac still written in our day, scarcely any essential differences can be discovered between texts composed at so long an interval. Between these two limits Aramaic may be said to have varied no more than the language of Cicero from that of Ennius” (*Renan*). The most striking features of Semitic speech are: (1) The strong phonetic system, with several deep gutturals (*kh*, *q*, *gh*, etc.) unpronounceable by Europeans, yet preserved for thousands of years in the hottest inhabited region of the globe; (2) the trisyllabic verbal roots, consisting mainly of three consonants (triliteral, with a few biliteral, quadriliteral, and pluriliteral), “moved” by vowels, but never changed in sound or sequence in any of the branches. Thus from root *qtl* = “kill,” Arab. *qatala*, Heb. *qātal*, etc., “he killed;” (3) the remarkable verbal process, without analogy in any other language, by which from this triliteral root were developed, chiefly by internal vowel change and prefixed servile letters (*h*, *t*, *n*, *s*), as many as 15 thematic forms (intensives, reciprocals, causatives, reflexives, iteratives, etc.), in the Semitic mother-tongue, of which 12 or 13 are preserved in Himyaritic, 11 in Arabic, 5 in Hebrew, and more or less in the other branches. Thus Arabic, *qatala*, *qātala*, *haqtala*, *taqatala*, *hinqatala*, *histaqtala*, etc., each with active and passive voice, personal endings, participles, gender, but two tenses only, the complete and incomplete; for acts are thought by the Semitic mind, not as taking place in past, present, or future time, as they are thought by the expansive Aryan mind, but as either done absolutely (past) or not complete at time of fact last mentioned, the incomplete or “imperfect” thus vaguely answering to our present and future.

The verb also incorporates both the direct and indirect personal objects; but in other respects Semitic inflection is poor—declension restricted to three cases (subjective, possessive, and objective), feebly marked by nasalisation, little adjectival change, dual confined to noun, no neuter gender, no optative, no word-building by prefixes or other process. Peculiar to the Arabic branch are the so-called “broken plurals” on which, being really singular collectives, secondary plurals may be built. There are over thirty typical forms, such as *jauhar*, “a gem,” *jawāhir*, “jewellery;” *amīr*, “prince,” *umarā*, “the aristocracy;” *qarīb*, “a relation,” *aqribā*, “kindred;” *khabar*, “news,” *akhbār*, “tidings;” *kāfir*, “unbeliever,” *kuffār*, “the infidel.” Several of these or analogous forms survive in the cognate Himyaritic, but the principle on which they have been developed has disappeared from all the other members of the Semitic family. All the Semitic languages except Assyrian (*see* above) are written in various forms of an alphabet attributed to the Phœnicians, and ultimately traceable to a hieroglyphic (Egyptian or Babylonian) source. This graphic system runs from right to left, and makes originally little provision for the vowel sounds, except in the Himyaritic of Abyssinia, which reverses the order and develops a full vocal series by a uniform modification of the consonants. Apart from the Assyrian now being revealed by the decipherment of the cuneiform writings, Semitic literature has been successively cultivated, first by the Jews (Hebrew period closing with the 6th century B.C.), then by the Aramæans (from 6th century B.C. to 7th A.D.), and, lastly, by the Arabs (from 7th century A.D. down to the present day). The two first are mainly religious, the third religious and general. (Renan, *Histoire, etc., des Langues Sémitiques*.)

Semitic Race, a main division of the Caucasian stock (q.v.), whose original domain was confined to the south-west corner of Asia—that is, the region comprised between the Iranian plateau and the Persian Gulf on the east, and the Red Sea and Mediterranean on the west, with no clearly-defined limits towards the north. From this relatively narrow territory the Semites spread in prehistoric times to the Ethiopian highlands (Abyssinia), and along the southern shores of the Mediterranean, and in historic times to nearly the whole of North Africa, to the East African coast-lands beyond the Zambesi, and to parts of Persia, India, and Malaysia. The name is purely conventional, being taken, for want of a better, from Sem (Shem), their assumed progenitor, although the Biblical genealogies make no claim to scientific accuracy. Apart from the doubtful Hittites, there are five great historical groups: (1) The *Assyrians* of Mesopotamia; (2) the *Arameans* (Syro-Chaldeans) of Syria, parts of Palestine and the Lower Euphrates; (3) the *Canaanites* (Hebrews, Phœnicians, Carthaginians, and others) of Palestine and the Mauritanian seaboard; (4) the *Arabs* of the greater part of the peninsula named from them; (5) the *Himyarites* of south-west Arabia (Yemen) and Abyssinia. Of these all but the Jews (q.v.) and Abyssinian

Himyarites have either disappeared or else been assimilated in speech to the Arabs, who may be said to have absorbed nearly all other members of the Semitic family much in the same way that the Latins absorbed all other members of the old Italic family. The type, as best represented by the Assyrians of the ancient monuments, by the Jews and Arabs, offers considerable diversity in the details, but is essentially Caucasian in its main characters, being distinguished by perfectly regular and expressive features, fine oval face, large and often aquiline nose depressed at the root, small pointed chin, forehead straight but not high, black almond-shaped eyes, moderately dolichocephalic head, glossy jet-black hair, full beard, skin fair but easily bronzed by exposure, stature rather below the average European. This type approaches nearest to the Hamitic, at least as represented by the Berbers, and there are linguistic and other reasons for assuming a primitive Hamito-Semitic race, whose original home may have been either in North Africa or South-West Asia, whence the two branches diverged long before the oldest Babylonian and Egyptian records. Compared with the Aryan, the Semitic intellect may be described as less varied, but more intense, a contrast due to their monotonous and almost changeless environment of yellow sands, blue skies, flora and fauna limited to a few species and mainly confined to oases and plains reclaimed by irrigation from the desert, everywhere presenting the same uniform aspect. Hence to the Semites mankind is indebted for little philosophy and science, but for much sublime poetry associated with many profound conceptions of a moral order, resulting in the three great monotheistic religions of the world—the Jewish, Christian, and Mohammedan. Expansion and progress are the dominant characteristics of the Aryan, concentration and immutability of the Semitic, intellect.

Semler, JOHANN SALOMO (1725–94), German theologian, was educated at Halle University, and eventually became its professor of theology in 1751, which post he retained till his death. He was also director of the theological seminary at Halle. His writings are chiefly interpretations of the Old and New Testaments, and, though slightly rationalistic, are considered of much importance.

Semolina, a farinaceous food, consisting of the large hard parts of wheat, which remain in the bolting machine when the fine flour has disappeared. It is used for making puddings and soups.

Sempach, a town in the canton of Lucerne, Switzerland, on the E. shore of the small lake of Sempach, 9 miles from Lucerne. Here in 1386 Arnold von Winkelried fell in a victory over the Austrians, and a yearly festival commemorates his death.

Senancour, ÉTIENNE PIVERT DE (1770–1846), French metaphysician, was born at Paris, and was destined by his parents for the priesthood, but he ran away, and, going to Switzerland, married there. Financial embarrassment drove him back to Paris, where he began to write for a livelihood. During

the reign of Louis Philippe he was granted a pension. His principal works are his *Obermann* (1804) and *L'Amour considéré dans les lois réelles* (1805), which have been often reprinted. He was much influenced by Rousseau, and wrote several sentimental reveries of a deistical nature.

Seneca, LUCIUS ANNÆUS, Roman sage, was born at Corduba, in Spain, about the commencement of the Christian era, and was taken to Rome at an early age. He became an advocate of some note, but was banished by Claudius to Corsica for eight years on a charge brought against him by Messalina of scandalous fame. Agrippina, after her marriage with Claudius, procured, in 42 A.D., his recall, and he was appointed tutor to her son Nero, with whom he became a great favourite. He acquired enormous riches, and these were probably the cause of his downfall; for it is believed that the charge of conspiracy brought against him by Nero in 65 was merely a pretext for obtaining his wealth. He was ordered to destroy himself, and succeeded in doing so after some trouble. He was a Stoic and a sage, but he did not exert himself in inculcating virtue in his pupil, and he even excused Nero's murder of his mother. He wrote much, and his works have often been reprinted, notably *De Consolatione*, *De Ira*, *De Vita Beata*, *De Animi Tranquillitate*, and *De Providentia*. Some tragedies, which are artificial imitations of Greek models, are also ascribed to him.

Senega. There are two preparations made from senega root in the Pharmacopœia: an infusion and a tincture. They are often administered alone or in combination with other remedies in bronchitis and other lung affections, with a view to increasing mucous secretion and promoting expectoration.

Senegal. 1. A river of West Africa, formed by the confluence (in lat. 13° 50' N., long. 10° 50' W.) of the Bafing and the Bakhoy. It flows N.W. as far as Mafu, and, then turning W. and S.W., enters the ocean at St. Louis, after a journey of some 1,000 miles. It is navigable at certain seasons by vessels of slight draught as far as Medine, over 500 miles. Its two largest tributaries are the Baulé and the Falemé, and below Mafu its delta includes several large islands.

2. A French colony, which takes its name from the river and has its capital at St. Louis, maintaining a line of forts and stations along the coast of the frontiers of Gambia, northwards to Bamuko on the Niger, and up the river to the territory that separates Gambia from Sierra Leone. The resources of the colony have been vigorously developed, the import and export trade amounting to four or five millions, and the ports of Dakkar and St. Louis being connected by railway.

Senegambia, the name given to the tract of country in West Africa which is drained by the Senegal and the Gambia rivers. Its limits are still undetermined, but the Atlantic bounds it W., and Sierra Leone is on the S. frontier. To the N. and W. the Sahara and the Joliba or Upper Niger offer but vague limits. The whole area may roughly be estimated at 400,000 square miles. The seaboard,

especially in the S., is flat, swampy, and covered with rank vegetation, but the country rises inland to a mountainous ridge having an elevation of three or four thousand feet, is watered by many rivers, and is fairly fertile and healthy. Millet, rice, maize, sugar, indigo, tobacco, cotton, oranges, figs, etc., are grown, but only for home use. The French colony of Senegal (q.v.) occupies the northern portion, the British settlement of Gambia (q.v.) lying S. of Cape Verde, whilst below this the Portuguese have settlements and more recently the French have established themselves. The population chiefly consists of negroes, with an infusion of Berbers of Arab blood, Europeans being very few.

Senna, the leaflets of various species of the leguminous genus *Cassia*, containing a nauseous volatile oil and a purgative principle known as *cathartic acid*. The plants vary in size, but their leaves are pinnate, and the leaflets are distinguishable from adulterants by being slightly oblique at their bases. *C. acutifolia* and *C. angustifolia* are shrubs, the one, known as Alexandrian or Nubian Senna, native of tropical Africa from Timbuctoo to Nubia; the other, known as Bombay or Tinnevely Senna, native of Somaliland, Arabia, and the Punjab. *C. marilandica* is the source of American Senna. In addition to a cathartic acid, the leaves contain oxalic, tartaric, and malic acids. The principal preparations of senna are the syrup, tincture, infusion, confection, and the compound senna mixture, or "black draught." The dose of the last named is 1 to 1½ fluid ounces. The action of senna is to stimulate the muscular coat of the intestine, and black draught is one of the most commonly employed among purgative preparations.

Sensation, a state or modification of consciousness, supposed to be caused by a stimulus acting on the nervous system (q.v.) and transmitted to the brain through the afferent nerves. Sensations fall into three classes: (1) those which are attributed to the impact of some external object on the special organs of sense; (2) those which fall under the head of general sensibility, such as the comfort or discomfort attending the action of the digestive organs; (3) those which accompany muscular activity, the stimulus being apparently derived from the adjustment of the muscles, tendons, and joints. The Association psychologists commonly speak as though each sensation were a separable unit assignable to some one cause or agent, but against this view there is a twofold objection. In the first place, the single simple sensation is a mere ideal; practically every sensation contains representative elements, *i.e.* elements derived from past experience; and, secondly, the interaction of the various factors which produce sensation is much greater than is commonly supposed. Thus there can be no doubt that in sensations of taste a tactile or olfactory element is frequently present. Again, the changes in quality which accompany the increase or decrease of the stimulus applied to a special sense point to a mysterious complexity which lies altogether beyond our present means of analysis. This observation may be extended to the sensations of

pleasure and pain which arise in connection with those communicated through the sense organs. The correct view would therefore seem to be that sensation is a complex whole, the segregation of which into parts is due to reflection rather than intuition. On this ground it may be maintained that the phenomena of consciousness presented by the special senses are merely modifications of a fundamental mass of general sensation, but as yet we possess no clue which would enable us to trace the differentiation. [PSYCHOLOGY.]

Sensitive Plant (*Mimosa pudica*), a branching South American annual belonging to the sub-order Mimoseæ of the order Leguminosæ, now naturalised in many tropical countries and common in our hot-houses. The leaves are bipinnate, with two or three pairs of pinnae, each with a large number of small pinnules. These are exceedingly sensitive to contact, assuming the nocturnal position immediately on being touched. [SLEEP IN PLANTS.] The seat of the movements is the parenchymatous swellings (*pulvini*) at the base of each leaflet, petiolule and petiole, and the movement is produced by an influx or efflux of water in the cells of one side of these structures. The conduction of the stimulus is effected by the continuity of the protoplasm through the cell-walls in the pulvini. The leaflets fold together down their midribs (conduplicate), each pinna then falls to an oblique downward direction, and then the main petiole falls similarly. Sudden variations in temperature or in intensity of light, electric and chemical stimuli, produce the same effects as contact.

Sepal. [CALYX.]

Septa, the names of the plates of calcareous or fleshy material which divide the bodies of certain animals into more or less well-separated chambers; thus they occur between the body-segments of worms, or forming the radiating plates which divide the cavity of corals into series of chambers or loculi.

Septaria, concretionary nodules of clay-ironstone or impure limestone, in which the inner first-formed parts have contracted more than the outer, producing crossing series of cracks which have afterwards filled by infiltration with crystalline calcite. The clay-ironstone septaria occur in the shales of the Coal Measures, and the calcareous ones in many clays. Those in the London Clay, known to quarrymen as "turtle stones," are often of a grey earthy texture, traversed by lemon-yellow septa, and are cut and polished as table-tops. They range from six inches to several feet in diameter. They are largely collected in Sheppey and dredged up off Harwich for the manufacture of Roman cement.

September, now the ninth month of the year, was the seventh (Latin *septem*, "seven") in the Calendar (q.v.) of the Romans.

Septicæmia. [PYÆMIA.]

Septuagint, THE, OR ALEXANDRIAN VERSION OF THE OLD TESTAMENT (from Latin *septuaginta*,

seventy), is a translation of the Hebrew Scriptures into Hellenistic Greek, probably undertaken during the reign of Ptolemy (II.) Philadelphus (284-47 B.C.). The name is probably due to the legend related in the *Letter of Aristeas*, a forgery of early date, the author of which represents himself as a contemporary of King Ptolemy. According to this account, Ptolemy, in his zeal for learning, sent to Palestine for Jews to translate the books of the Old Testament. The seventy-two (not *seventy*) learned men commissioned to execute the task were placed in seclusion on the island of Pharos, and at the end of seventy-two days the version on which they had agreed was dictated to the librarian Demetrius. Internal evidence, furnished by the Septuagint itself, shows that the details of this story are fictitious. It was certainly translated by Alexandrian, not Palestinian, Jews, and differences of style and treatment show that it was the work of independent translators, separated by considerable intervals of time. The Septuagint furnishes valuable materials for Old Testament criticism; for differences in the arrangement of the books, as well as various omissions and additions, show that it was translated from a different text from that which has been preserved. It eventually supplanted the Hebrew Scriptures in Palestine itself, and from it are taken the quotations of Christ recorded by the Evangelists. The Septuagint has much literary value as the great monument of Hellenistic Greek. [HELLENIST.]

Sequestrum, a section of dead bone or cartilage which separates itself from the living surrounding bone or cartilage.

Sequoia, a genus of Coniferæ named after a remarkable Cherokee Indian (otherwise George Guess), who gave his tribe a written syllabic alphabet of eighty-six characters, and died in New Mexico in 1845. The genus is characterised by peltate cone scales, each bearing from five to seven seeds. There are only two living species, both natives of Western North America, *S. gigantea* (the Wellingtonia of our gardens, or Big or Mammoth Tree of Americans), and *S. sempervirens* (the Californian Redwood). The Mammoth Tree is a native of the Sierra Nevada, and reaches over 1,000 years of age, 450 feet in height, and 112 feet in circumference. It was discovered in 1850, and introduced into England in 1853. It grows well in deep clay soils on high ground. The Redwood has a wider range in latitude as a wild tree, and reaches 300 feet in height. It has shaggy, reddish bark and very dark foliage. Its wood is of good texture, but monotonous in grain. It is a little used in cabinet work. Fossil species of *Sequoia* occur in the Gault of Folkestone, the leaf beds of Mull (Eocene?), the Oligocene of Switzerland, and the Pliocene of Italy.

Seraglio properly means any enclosure (Italian *serraglio* from *serra*, "a bolt"), but its meaning in English is now identical with that of harem (q.v.). The word has been confused with the Turkish *serai*, "a palace." The Seraglio (*eski serai*) at Constantinople, including mosques, the harem, etc., is now no longer the Sultan's residence.

Seraing, a town in the province of Liège, Belgium, 3 miles from Liège on the right bank of the Meuse, being connected with Jemeppe by a suspension-bridge. It was formerly the abode of the Prince-Bishops of Liège, whose palace was in 1817 converted into ironworks by John Cockerill. The construction of locomotives is the chief industry. The coal- and iron-fields of Belgium are in the immediate neighbourhood.

Serao, MATILDE (b. 1856), an Italian novelist, born at Patras in Greece. She has published *Cuore Inferno* (1881), *Fantasia* (1883), and other books depicting Neapolitan life.

Seraphim are mentioned in the Bible only in the vision of the prophet Isaiah (vi. 2-6). They have six wings, but otherwise their attributes are human. They are seen hovering on either side of the throne of the Almighty, proclaiming the *tris-agion* in antiphonal chorus. Jewish commentators regarded them as an order of angels, and were followed in their interpretation by the Christian Church. The word means "consuming," and is used in Num. xxi. 6 of a poisonous kind of serpent. The idea conveyed is probably the "devouring fire" (cf. Isa. xxxiii. 14) of the Almighty, suggested by the thunderstorm.

Serapis, SARAPIS, or OSARAPIS, an Egyptian deity, whose worship was introduced from Greece by Ptolemy (I.) Soter. He was identical with the Greek Hades, the ruler over the underworld. The name is said to be contracted from Osiris-Apis—i.e. the dead Apis (q.v.), worshipped as Osiris. The Egyptians who had remained unhellenised refused to acknowledge the new god or to allow *Serapea* (temples of Serapis) to be built within the walls of their cities. The worship of Serapis gradually spread through Asia Minor, and in 146 A.D. was formally established at Rome by Antoninus Pius, but only to be abolished soon afterwards by the Senate.

Serbs (SRB, SORB), collective name of the Southern division of the Slav race (Yugo-Slavs), whose original home was the region of the Carpathians. Here many survived till the 9th or 10th century, and in Alfred's time the Surpe (Surfe) were still seated on the Oder (Orosius, i. 12); but the great bulk of the nation had already, in the 7th century, passed south of the Danube, where they rapidly overran a great part of the Balkan Peninsula, penetrating almost to the southernmost extremity of Greece. Later, through pressure of the Byzantines on the east, of the Bulgars on the north, and of the Albanians on the west, the Serb domain was gradually contracted to its present limits, comprising the whole of Servia, Bosnia, Herzegovina, Croatia, Dalmatia, Montenegro, and part of Istria, with collective population over 8,000,000. Although politically dismembered, the Serb race preserves a strong national sentiment, which must form a potent factor in the future reconstitution of the Balkan Peninsula. This fellow-feeling is largely due to a community of traditions, usages, and especially language and literature, which present great uniformity throughout the

whole of the Serb domain. Serbo-Croatian, as the common language is called, is the softest and most harmonious of all Slavonic tongues. Its well-preserved phonetic system gives it an important place in the family, and its literature is especially rich in national songs. A great number of these *pjesma*, as they are called, have been collected and published; many are undoubtedly very old, and the form in which they still exist shows how little the language has changed during the course of centuries.

Serge, a twilled worsted fabric with a rough surface. It is commonly dyed black or dark-blue, and wears extremely well when the quality is good.

Sergeant (Old French *sergent*, from Latin *serviens*, "serving"), a non-commissioned officer next above a corporal in rank. His chief duties consist in maintaining discipline, teaching drill, and commanding small bodies as escort, etc. Sergeants have the overseership of the barracks, and are assistants to their officers in the field. Every company of infantry contains four sergeants, the senior being denominated the colour-sergeant. The *sergeant-major*, who ranks above the sergeants, does not hold any separate command, but is responsible for the general discipline of the corps. *Serjeants-at-Law* were barristers of superior degree having precedence over junior barristers. [BARRISTER.]

Series, in algebra, is any expression in which consecutive terms are formed in agreement with some regular law. Series are either finite or infinite, according as the number of terms is limited or not. In a finite series of n terms, the sum of these n terms is always some function of n , and has a certain definite value, but the sum of an infinite series may or may not have a definite value, according to the form of the series. The series is said to be *convergent* when its sum cannot exceed a certain definite value, however many terms we take; and it is said to be *divergent* when its sum can be made greater than any number we like to name, provided that we take a sufficient number of terms. If we can actually find the sum of n terms of an infinite series, we can at once discover whether the series be convergent or divergent by giving n an infinite value. For instance, the sum of n terms of the series

$$1 + x + x^2 + \dots + x^{n-1} \text{ is } \frac{1 - x^n}{1 - x}.$$

If x be less than 1, this fraction becomes $\frac{1}{1 - x}$, when n is very great; hence the series is convergent. If $x = 1$, the series becomes $1 + 1 + 1 + \dots$ to n terms, and is therefore divergent. If x be greater than 1, the fraction can be written $\frac{x^n - 1}{x - 1}$ and can be made as large as we please by taking n great enough. The series is therefore divergent. In many cases, however, we cannot easily find the sum of n terms of an infinite series, and then special devices have to be used to determine whether the series be convergent or not. For these, the reader is referred to books on algebra. Series may be

formed in accordance with various laws; hence different methods must be employed in their summation. A series of numbers in arithmetical progression (q.v.), or in geometrical progression, can be summed by means of the general formulæ, and a series partly geometrical and partly arithmetical will generally admit of an easy solution. Some series can be referred to other series, involving sums of the powers of the natural numbers, special methods being used for these. Many series can be reduced to the form of a binomial expression and so summed at once; others can be formed which yield exponential or logarithmic series after judicious treatment. There are other series of more general forms which need special treatment, and it may be said that the difficulty of summing any series lies chiefly in determining the best method to use rather than in applying the method when found.

Seringapatam, once the capital of the native state of Mysore, Southern India, stands on an island of the same name in the Kaveri river, 9 miles from Mysore. It was founded as a fortress about 1450, and was held by Tippoo Sahib against the British until 1799, when it was finally stormed by Lord Harris. The island, 3 miles long by 1 mile broad, is very fertile, and on its opposite side is the mausoleum of Hyder Ali and his son.

Serous Membrane. The membrane which forms the lining wall of the various serous sacs which are met with in different parts of the body. These serous sacs are the pericardium, the pleuræ, the peritoneum, and the serous sacs which envelop the testes. See articles on these subjects.

Serpent, a powerful bass musical wind-instrument, now almost obsolete. It consists of a wooden tube about 8 ft. in length, gradually increasing in diameter from the mouthpiece to the open end, and twisted so as to resemble a serpent. It is covered with leather, and has a mouthpiece resembling that of a horn or trombone. It was invented by a French priest at Auxerre in 1590.

Serpentine, a hydrous silicate of magnesia and iron, $3(\text{MgFe})\text{O}, 2\text{SiO}_2, 2\text{H}_2\text{O}$, of a dull green, reddish or brownish colour, with specific gravity 2.5 to 2.7, and hardness 3 to 4. It occurs as an alteration-product in olivine (q.v.), or, less frequently, of hornblende and augite; and, as the serpentinisation of these minerals proceeds along their cleavage planes, it presents distinctive structures—that from olivine being irregularly-meshed; that from augite, rectangularly-netted or bladed, and that from hornblende, latticed, with blades intersecting at angles of 124° . *Serpentinite*, or massive serpentine occurring as a rock, is dull green and red, mottled and veined with fibrous chrysotile and white steatite, and is easily scratched with a knife. Many serpentinites occur in dykes and veins, and are undoubtedly formed from the hydration of olivine-basalts (peridotites), and others from diabase, gabbro, or hornblende rocks. Serpentine also occurs, however, disseminated through limestones forming *ophicalcites* (q.v.), which have been supposed to be altered dolomites, or marine deposits,

but are probably neither. Serpentinite occurs at the Lizard in Cornwall, in Anglesea, Aberdeenshire, and Connemara, and is used for ornamental purposes.

Serpents. [SNAKES.]

Serpent-Worship, a particular case of animal-worship (q.v.). Traces of it appear in some of the pictures on Egyptian mummy-cases, and there are references to it in classic literature. The Jews must have been familiar with it, for it was one of the forms of strange worship into which they fell (2 Kings xviii. 4). It is probable that primitive serpent-worship arose from fear, and mixed with this may have been the vague hope that these venomous animals could be propitiated by offerings. The cobra is the sacred snake of India; the rattlesnake is venerated by some of the North American Indians, as are pythons on the west coast of Africa. The conception of the serpent as a symbol of immortality belongs to a somewhat advanced stage of culture.

Serpula, a genus of marine worms belonging to the class Chaetopoda (q.v.), the sub-class Polychæta (q.v.), and the order Tubicola. It lives in a strong calcareous tube attached to shells, rocks, etc. This may be straight, sinuous, or tortuous. There are eight living British species.

Serrano y Dominguez, FRANCISCO, DUKE DE LA TORRE (1810-85), a Spanish general and politician, born near Cadiz. He acquired much influence with Queen Isabella, and became one of the leading actors in the political intrigues and insurrectionary movements of her reign. After the temporary overthrow of the Bourbon dynasty (1868) he was placed at the head of the Provisional Government, and received the title of Regent (1869). On the accession of Amadeus (1870) he became commander-in-chief, and during the following years gained several successes against the Carlists. He withdrew from Spain on the proclamation of Alfonso XII., but returned in 1875.

Sertorius, QUINTUS (d. 72 B.C.), an able Roman statesman and general, born at the Sabine village of Nursia. He served under Marius in the victory over the Teutones at Aquæ Sextiæ (102 B.C.), and joined that statesman as leader of the democratic party against Sulla (88), although he disapproved of his personal character. He was not responsible for the carnage wrought by Marius and Cinna in 87, but showed his desire to check it by putting to death several hundred blood-stained slaves. On the return of Sulla from the East in 83, he withdrew to Spain, where he maintained the Marian cause in a desultory but vigorous fashion, taking part in the Mediterranean expeditions of the Cilician pirates and conducting a successful campaign in Mauretania. It was his aim to establish a strong government in Spain and to introduce the Roman type of civilisation among the natives, and by his statesmanlike and equitable rule he won the confidence both of the Spaniards proper and of their westerly neighbours, the Lusitani. He was assassinated at a banquet through the instrumentality of his subordinate and rival Perperna.

Sertularians. [SEA-FIRS.]**Serum.** [BLOOD.]

Serval (*Felis serval*), the Bush-cat of the Dutch colonists at the Cape. The total length is a little over 3 feet. The fur, yellow above and white below, is spotted with black.

Servetus, MICHAEL (MIGUEL SERVETO) (1511-53), Spanish theologian and physician, was born at Tudela in Navarre. After studying at Saragossa and Toulouse, he travelled in Italy and in Germany, where he became acquainted with the reformers. From 1535 onwards he lived chiefly in France. The Socinian tendencies of his *De Trinitatis Erroribus* (1531) excited the animosity both of Catholic and Protestant divines, and his indiscreet efforts to maintain a friendly correspondence with Calvin resulted in his ruin; for it was probably through the latter's instigation that he was seized at Lyons in 1553. He escaped from prison, but, four months later, was captured whilst passing through Geneva, and, after a trial of two months, condemned and burnt at the stake.

Servia, a kingdom in the Balkan Peninsula, bounded N. by Austria, W. by Bosnia, E. by Bulgaria and Roumania, and S. by Turkey, and having an area of about 18,760 square miles. The surface is for the most part mountainous, the highest elevation being Mt. Kopaonik in the S. (7,000 feet). Woods clothe the hillsides, and the valleys and low grounds beside the rivers Morava, Nishava, Drina, Save, and Danube, furnish excellent pastures, and yield crops of maize, wheat, flax, hemp, and



MAP OF SERVIA.

tobacco. Fruit is abundant, the national drink *slivovitz* being distilled from plums. Iron is profitably worked at Maidanpek; coal and lignite are met with, but the mineral wealth remains unexplored. The climate is warm in summer, but very severe in winter on the uplands. Manufacturing industries scarcely exist. Belgrade is the capital, other towns being Nish, Semendria, Alexinath, Kragojevatz, Shabatatz, and Vrania. Servia first appears as a distinct principality in the middle of the 12th century. Two hundred years later it

was conquered by Turkey, and never recovered freedom until the revolt under Kara-George in 1801. A troublous period ensued, but in 1829 the Porte recognised Alexander Milosch (I.) Obrenovitch as hereditary prince, but the country was the scene of perpetual disorders. In 1868 Michael Obrenovitch was murdered by the opposite faction, and was succeeded by his cousin Milan, who was proclaimed king in 1882, having previously married Natalie Keschko, a Russian lady. An ill-advised war with Bulgaria might have ended in utter disaster, which was averted by a treaty in 1886. The Austrian sympathies of the king and the Russian proclivities of the queen led to a divorce in 1888, but next year the combination of the Radical majority in the Skupshtina with the friends of the queen and the partisans of the Karageorgevitch aspirant compelled Milan to abdicate in favour of his son Alexander, a boy of fourteen. A triumvirate of Regents was instituted, but in 1893 the young king suddenly declared himself of age and displaced the Regents, who were supporting the government of a minority. Soon afterwards Milan was allowed to return, a reconciliation being effected with Queen Natalie. [SERBS.]

Service-Tree is a tree (*Pyrus Sorbus*) belonging to the same genus of the Rosaceæ as the apple, pear, and rowan. It grows from 20 to 60 feet high, and is wild in France and Italy, but doubtfully so in England. It lives to a great age, producing a hard, heavy, fine-grained wood, susceptible of a high polish, much in request in France for cogs, screws, rulers, etc., and suitable for coarse engraving. Its leaves are imparipinnate and serrate; its cream-coloured flowers small; and its fruits less than an inch across, either apple-shaped or pear-shaped, greenish-brown with rusty specks, and austere, requiring bletting like those of the medlar. The allied British species (*P. torminalis*) is known as the Wild Service, and its berry-like pomes are termed "Chequers" in country districts.

Sesame (*Sesamum indicum*), an Indian herb belonging to the order Pedaliaceæ, allied to the Labiatae (q.v.), the numerous seeds of which yield 40 to 44 per cent. of a tasteless, straw-coloured fixed oil, known as *gingelly oil*, the seeds themselves being known also as *tîl seed*. It is the oil of India, and is used instead of, or as an adulterant of, olive oil, or, when of very good quality, of oil of almonds. It is itself adulterated with ground nut oil. The plant is now cultivated in southern Europe, and the seeds are largely used in soap-making, being chiefly crushed at Trieste and Marseilles. The seed contains 76 per cent. of olein, together with stearic, palmitic, and myristic acids; but the oil is apt to become rancid. In India it is used in cooking, for lamps, and as an unguent. From 75,000 to 100,000 tons of the seeds are exported annually, Marseilles taking half that amount.

Sesamoid Bone, a small mass of bone, developed in the substance of a tendon; the patella, or knee cap, is an example of a sesamoid bone.

Sesostris, a semi-mythical king of Egypt who,

according to Herodotus and other Greek historians, extended his rule over the whole known world. The legends concerning him are supposed to have been based on the achievements of Ramses II. and several other monarchs.

Sessions, COURTS OF. Sessions of the Peace are sittings of the magistrates or justices of the peace for the exercise of their jurisdiction. They are of three kinds: *petty, special, quarter* or *general sessions*. (1) *Petty Sessions* is an occasional meeting of two or more justices for the transaction of business in which more than one justice is required. (2) *Special Sessions* is a meeting of two or more justices held for a special purpose, such as the licensing of an alehouse, etc. (3) *Quarter or General Sessions* is a Court of Record held every quarter for execution of the authority conferred on the justices by their Commission. Formerly they had jurisdiction to try cases of treason, murder, manslaughter, etc., but their jurisdiction is now restricted to comparatively petty offences.

Sestertius (literally, "that which contains two and a half," from *semis* (= *semi*), "half," and *tertius*, "third"), a Roman coin, which originally contained $2\frac{1}{2}$ asses, being a quarter of the denarius, which contained 10 asses. When the denarius was made equivalent in value to 16 asses, that of the sestertius became 4 asses. The sestertius was worth about 2d. of our money. The sestertium, a money of account, was equal to a thousand sestertii.

Seton. A piece of foreign material, such as a skein of silk or a guttapercha tube, is sometimes threaded through the skin, or inserted into a sinus, with a view to setting up counter-irritation, or promoting suppuration.

Setter, a breed of sporting dogs that formerly marked game by "setting" or crouching down. This was at the time when birds were netted. Since the introduction of firearms setters have been broken to mark like the pointer (q.v.). Spaniels were originally used as setters, and the English breed probably sprang from a cross between the spaniel and the pointer. The English setter is generally white, marked with red or ticked with black; but there is great diversity in the coloration. The coat should be soft and wavy, the limbs thinly and the tail deeply fringed, and there should be a good growth of hair between the toes. The Gordon setter is derived from the English setter crossed with a collie bitch, broken to set, and is black and tan, with a head somewhat like that of a bloodhound. The Irish setter, of unknown origin, is less stoutly built, and generally red.

Settle, ELKANAH (1648-1723), a dramatist and poetaster of the Restoration period, now remembered only as the Doeg of Dryden's *Absalom and Achitophel*. He incurred the laureate's satire, which is free from malice, by his absurd vanity in thinking himself the better poet of the two. He sank into poverty, and died a pensioner at the Charterhouse.

Seven. A mystical significance was attached

to this number by the Hebrews, Egyptians, Persians, Greeks, and other ancient races. Its sacred character was probably due to the seven planets and the weekly changes of the moon. In the Old Testament it figures conspicuously not only in the religious observances of the Jews, but in the record of actual historical events. It occurs frequently with a symbolic force in the imagery of the Apocalypse. Various multiples of seven are also used in the same manner. In ancient Greece the number was associated with Apollo and with Dionysus, the region in which its magic properties were most fully recognised being the island of Eubœa. Such mediæval notions as the Seven Deadly Sins doubtless originated in similar ideas.

Seven Bishops, THE, the name given to the prelates who in May, 1687, drew up a petition at Lambeth, urging James II. not to enforce his order that the clergy should read his Declaration of Indulgence at divine service. They were tried on the charge of uttering a seditious libel, but acquitted amidst general rejoicings (June 30). The bishops were Sancroft of Canterbury, Ken of Bath and Wells, White of Peterborough, Lloyd of St. Asaph, Trelawney of Bristol, Lake of Chichester, and Turner of Ely.

Seven Sleepers of Ephesus, THE, form the subject of an ancient Syrian legend, the earliest mention of which in the West occurs in the 6th century in the writings of Gregory of Tours. The story is that during the Decian persecution seven Christian youths took refuge in a cave, and were there imprisoned by their pursuers, who rolled huge stones against the mouth. By the Divine favour they fell into a deep sleep, from which they were accidentally awakened by the movements of a shepherd after the lapse of nearly 200 years. One of the youths was sent to buy food, and as he drew near the town he wondered at seeing the cross erected over the gate and churches. Offering a coin of Decius in exchange for bread, he was arrested on the suspicion that he had discovered hidden treasure. A visit to the cave, however, convinced the citizens of the truth of his story. The sleepers were visited by the Emperor Theodosius, who learnt from them that the miracle had been wrought to confirm his faith in the resurrection. Thereupon the seven again sank into a calm sleep, from which they will not awake till the last day.

Seven Wise Men, the name given to those Greek sages who, before Socrates had laid the foundations of moral philosophy, expressed the highest wisdom of the time in a number of pithy aphorisms. Their names were Solon of Athens, Thales of Miletus, Pittacus of Mitylene, Bias of Priene, Chilon of Sparta (author of the famous "Know thyself"), Cleobulus, Tyrant of Lindus in Rhodes, and Periander, Tyrant of Corinth.

Seven Wonders of the World, THE, a name applied after the time of Alexander the Great to the seven most splendid monuments of the ancient world, viz. the Pyramids of Egypt, the Hanging Gardens of Babylon, the temple of Diana at Ephesus, the statue of the Olympian Zeus at

Athens, the Mausoleum at Halicarnassus, the Colossus of Rhodes, and the Pharos (or lighthouse) of Alexandria.

Seven Years' War, THE (1756-63), was due to the alarm occasioned in Europe by the aggressive designs of Frederick II. (the Great) of Prussia and the desire of the Empress Maria Theresa to recover Silesia from that monarch. Louis XV. of France, the Czarina Elizabeth, and Augustus, King of Poland, who was also Elector of Saxony, ranged themselves on the side of Austria, whilst England, already at war with France in the colonies, aided Frederick with money, placed an army in Hanover at his disposal, and promised him further assistance. In his first campaign Frederick overran Saxony, defeated the Austrians (who were marching to its relief under Marshal Browne) at Lobositz, and forced the Saxon army to surrender. In 1757 Frederick invaded Bohemia and invested the Austrian army in Prague, but received a crushing defeat at the hands of Marshal Daun (June 18). Five weeks later the Duke of Cumberland, in Hanover, was defeated at Hastenbeck by Marshal d'Estrées, and agreed by the Convention of Closter-Seven to disband nearly the whole of his army; but at Rossbach Frederick was successful against an army composed of Imperialists and French troops under Soubise, and Silesia, which had meanwhile been seized by the Austrians, was reoccupied after his victory at Leuthen (December 5). These successes were followed by the withdrawal of the Russians from East Prussia. In 1758 the fortune of Frederick varied considerably. His inroad into Bohemia was cut short by a Russian invasion, and, although he was successful against these foes at Zorndorf, he was surprised and severely defeated by Marshal Daun at Hochkirch; yet, before the year closed, the Prussians had regained Saxony and Silesia. Frederick's fourth campaign (1759) was a series of disasters. He himself suffered a terrible reverse at Kunersdorf, and the surrender of Finck to Daun was followed by the Austrian occupation of Saxony. Against the ill-fortune of Prussia was to be set the almost unvarying success of Ferdinand of Brunswick in Hanover and Westphalia. He had been placed at the head of a new army by the British Government, who refused to recognise the Convention of Closter-Seven, and by his victory at Minden (August 1, 1759) finally drove the French behind the Rhine. English aid and his own indomitable energy enabled Frederick to resume the struggle in 1760, notwithstanding his impoverished condition. In spite of his success at Liegnitz (August 15), Berlin was captured by the allies in October, but the fierce battle of Torgau (November 3) drove the enemy from Silesia and saved Prussia from destruction. During the next year the war was carried on in a desultory fashion, owing to the exhaustion on both sides, Frederick's position being rendered more difficult by the withdrawal of the English subsidy after the death of George II. But in 1762 he pursued the struggle so vigorously—aided by his brother Prince Henry, and in the west by the Duke of Brunswick—that the French withdrew from the conflict, entering into treaties with Britain and

Prussia, which culminated in the Peace of Paris (February 10, 1763). Maria Theresa, left to carry on the war alone, had already found herself forced to conclude the Peace of Hubertsburg (February 15, 1763), in which she abandoned her claim to Silesia. The main result of the war, so far as England was concerned, was a great accession to her dominion and power in India and North America.

Severalty. A person is said to hold property in severalty when he is the sole tenant thereof, and holds them in his own right only, without any other person being joined or connected with him in point of interest during his estate therein.

Severn, THE, rises at Maes Hafren, on the N. slope of Plinlimmon, and flows in a semicircular course of 210 miles past Llanidloes, Newtown, Welshpool, Shrewsbury, Bridgnorth, Bewdley, Worcester, Tewkesbury, and Gloucester, till it opens out into the Bristol Channel. Its basin extends over 6,000 square miles, the chief tributaries being the Vyrnwy, the Stour, the Teme, the two Avons, and the Wye. Owing to its narrowness, it is subject to a strong tidal wave or bore. The Severn Tunnel at Bristol was completed in 1885.

Severus, ALEXANDER (205-235), a Roman emperor, the successor of Heliogabalus. He was an accomplished scholar and an able ruler and much beloved by his subjects; but he was murdered by his insubordinate troops under Maximianus.

Severus, L. SEPTIMIUS (146-211), one of the most able and upright of the later Roman Emperors, was born near Leptis Magna in Africa. On the assassination of Pertinax, in 193, he was proclaimed emperor at Carnuntum, the capital of his province Pannonia Superior, the legions in Germany and Illyria joining those under his own command. Didius Julianus offered but a feeble resistance, but he had to contend with more formidable rivals in Pescennius Niger and Clodius Albinus, the last of whom was vanquished in a fierce battle near Lyons in 197. The success of his Parthian campaigns (197-202) added the province of Mesopotamia to the Empire. His last three years were occupied with wars in Britain. He died at York.

Sèvres, a town of France on the left bank of the Seine, midway between Paris and Versailles. The Government Porcelain Factory, established in 1756, and rebuilt in 1876, employs many hands, and turns out some of the finest ceramic work in the world. The museum connected therewith contains specimens illustrating the whole history of the art, and there is also a school of mosaic.

Sèvres, DEUX, a department in the W. of France, bounded N. by Marne-et-Loire, E. by Vienne, S.E. by Charente, S. by Charente-Inférieure, and W. by La Vendée. Its area of 2,315 square miles is divided into three districts—viz. the Gâtine, the Plain, and the Marsh. The former, adjoining the Bocage, is rocky and poor; the second yields large crops of grain; whilst the third, the smallest in extent, is fairly fertile when drained. The horses and mules of the department are much esteemed, and the cattle, goats, sheep, and other

livestock are a source of considerable profit. Wine, cider, honey, and vegetables, are important products. Coal, peat, and freestone make up the chief mineral resources, though iron and other metals exist. Niort, the capital, St. Maixent, Bressuire, Melle, and Parthenay, are the chief towns, but all are poorly populated.

Sévigné, MARIE DE RABUTIN-CHANTAL, MARQUISE DE (1626-96), the most fascinating of letter-writers, was the daughter of Celse Bénigne de Rabutin, Baron de Chantal, the representative of an ancient Burgundian family. She lost her parents in early childhood, and was brought up by her mother's brother, the Abbé de Coulanges. In her 19th year she married Henri, Marquis de Sévigné, a gentleman of Brittany, to whom, in spite of his debaucheries, she seems to have been sincerely attached. In 1651 he was killed in a duel occasioned by one of his amours, and henceforward she devoted herself to the care of her little son and daughter and the cultivation of her numerous friendships. Her time was divided between her husband's country seat of Les Rochers, near Vitré, and the gay world of Paris, with occasional visits to her friends' châteaux after the marriage of her daughter (Françoise Marguerite) in 1669, to François Adhémar, Comte de Grignan, the Lieutenant-General of Provence. Excepting during the intervals when they were together either at Paris or in Provence, mother and daughter kept up a constant correspondence for 25 years, and the letters written by Mme. de Sévigné have ever been treasured by lovers of literature, not only for their graceful style, but for the picture they present of a noble, pure, and tender-hearted woman. The whole of Mme. de Sévigné's correspondence throws much valuable light on the history and social condition of the time.

Seville, a province and its capital in the south of Spain. The former has an area of 5,429 square miles, being bounded N. by Badajoz, S. by Malaga and Cadiz, E. by Cordova, and W. by Huelva and the Atlantic. Though rugged and barren where broken up by the Sierra Morena in the N., the greater portion consists of a rich plain traversed by the Guadalquivir from N.E. to S.W. All the vegetable products of Europe grow in abundance, oil, wine, oranges, and olives being exported largely. The rough grounds afford pasture to many sheep and oxen, and the mountains yield lead, copper, silver, iron, and coal. There are also salt-mines. Among the manufactures are silken and woollen goods, chocolate, tobacco, pottery, and glass, and since the development of railways trade has much increased. Important towns are Carmona, Ecija, Ossuna, Utrera, Moron de la Frontera, Marchena, and Lebrija. The capital stands on the left bank of the Guadalquivir, 355 miles S.W. of Madrid, and accessible for small vessels from the sea. In Roman times it was a prosperous city. It passed from the Goths to the Arabs in 712 A.D., and flourished under them until recovered by Ferdinand III. in 1248. The cathedral (1403-1519) is a fine example of Spanish Pointed Gothic. The Giralda Tower is partially Mauresque, but the

noblest monument of Arab rule is the Alcazar, a riverside palace. Other remarkable features of the city are the archiepiscopal palace (1697), the university (1567), the Casa del Ayuntamiento (1545), and the vast Plaza de Toros or bull-ring. There are considerable exports of skins, wool, silk, and oil, and the manufactures include cannon-founding, small-arms, tobacco, pottery and porcelain, petroleum, coarse woollen goods, silken fabrics, and preserves.

Seward, ANNA, (1747-1809), "the Swan of Lichfield," was the daughter of the rector of Eyam, in Derbyshire, who became a Canon of Lichfield when she was seven years old. *Louisa* (a metrical romance), the *Life of Dr. Darwin*, and her other works have long been forgotten, but she is remembered as the friend of Johnson and Sir Walter Scott.

Seward, WILLIAM HENRY (1801-72), American politician, was born at Florida, New York State, and was called to the bar in 1822. He was elected Governor of New York State in 1838, but in 1848 resumed practice as a lawyer at Auburn. During his two terms of office as senator (1849-59) he showed himself a zealous opponent of slavery, argued against the Compromise Bill, and helped to found the Republican party. His candidature for the Presidency not being adopted by his party (1860), he became Secretary of State under Lincoln (1861), an office which he retained till 1869. In the department of foreign affairs he encountered the difficulties occasioned by the War of Secession with singular ability and success. A desperate attempt was made on his life in 1865 by an associate of the assassin of Lincoln. He was the author of an able *Life of John Quincy Adams* (1849) and other works.

Sewer, a channel which serves to carry away waste water and liquid refuse, trade effluents, rainfall, etc.; the term drain is applied to a channel which carries off the drainage of one building only, and which communicates with a cesspool or similar receptacle, or with a sewer; a sewer being the larger duct which receives as tributaries the various drains which communicate with it. In some towns what is known as the *separate system* of sewerage is adopted, the rainwater being carried away by a series of ducts distinct from those which carry household and trade effluents. Where the separate system is not adopted, the capacity of the sewers must be so regulated as to enable them to remove storm waters. It is usually calculated in this country that the sewer should be capable of dealing with a maximum rainfall of one inch per hour, over and above the waste matters derived from other sources. The smallest sewers are usually made of earthenware pipes, varying from nine inches to two feet in diameter: the larger main sewers are made of brick, set in cement upon a bed of concrete; in vertical section their form is generally oval or egg-shaped rather than circular, this method of construction rendering them less liable to be silted up when only a small volume of sewage is flowing through them. Sewers are laid in straight lines

manholes being provided at the various junctions so as to facilitate inspection and to allow of the operations of flushing being performed. The fall of a sewer varies from about 1 in 100 in the smaller to 1 in 750 in the large channels.

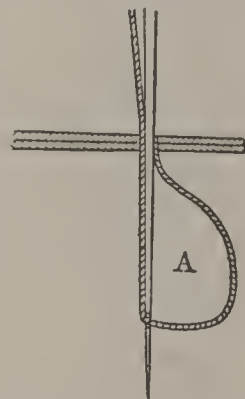
The composition of sewage is, curiously enough, very little altered by the fact of the exclusion or presence of water-closet discharges; the average composition of sewage from water-closet towns and from towns in which dry systems of removal prevail not being strikingly dissimilar. Sewage contains, on an average, some twelve hundred or thirteen hundred parts of solid residue in 1,000,000 parts by weight, the amount of the suspended solids being rather greater than the amount of those which are held in solution. The most valuable constituents of the sewage from a manurial point of view are the nitrogenous compounds, potash salts, and the phosphates. It has been calculated that, on an average, the annual quantity of sewage per unit of population is 100 tons, and, were this made to yield its theoretical value as manure, it would amount to nearly £1 per head.

The air contained in sewers differs somewhat in composition from the air of the atmosphere, gases being continually given off by the sewage and some percolation of ground air into the sewers usually occurring. Where the fall of a sewer is insufficient, and particularly when the level of a sewer is not properly regulated, or has become affected by subsidence (allowing of the collection of stagnant pools of sewage), this accumulation of foul gases in the body of the sewer is especially favoured. Under such circumstances the sewer-air may be a serious source of danger to those who work in the sewers. There is risk, too, of its finding its way into houses with imperfect drainage arrangements, and wherever means of escape are provided for the gases complaints of nuisance are almost sure to arise. With a view to securing some interchange of air in sewers and so making it safe for flushers and sewer men to enter them, and with a further view to allowing of the escape of air at times when there is an increased flow of sewage in the sewers, and particularly after rainfall, it is necessary to provide means of ventilation. Gratings situated in the centre of the roadway are usually employed for this purpose, the distance between such gratings being one hundred yards or thereabouts. In some instances shafts are carried up the sides of houses with a view to causing the sewer-air to escape at points where it will not cause offence. Sometimes the air from sewers has been extracted and passed through a furnace so that it may be rendered innocuous. The method of ventilation by gratings in the middle of the roadway is, however, very rarely productive of annoyance when the sewer is in a satisfactory condition.

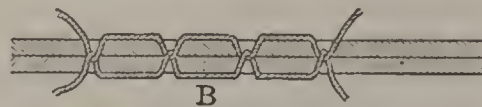
The methods of disposing of town sewage have received a good deal of attention during recent years, especially since the undesirability of passing sewage directly into streams has been insisted upon. Some form of chemical treatment (the essence of which consists in precipitating the organic matter by the addition of agents such as lime, sulphate of alumina, etc.) is usually adopted.

The effluents after such treatment are in many cases still a source of injury to the streams into which they are discharged. Filtration of sewage is sometimes had recourse to, the material being discharged over a porous soil, and the flow being from time to time suspended in order to permit fresh supplies of oxygen to obtain access to the filter. The method of broad irrigation, in which the sewage is distributed over a sewage farm and utilised as manure for certain crops, has also been employed in several instances. This is no doubt the best means of dealing with sewage when land in sufficient quantity and of suitable character is obtainable.

Sewing Machines have been undergoing a continual process of development since 1830, when Barthélemy Thimonier, a French tailor, arranged a mechanically-moved crochet needle which drew loops of thread through the cloth, each succeeding loop being passed through the previous one, thus making a chain stitch. The modern machine practically originated with Walter Hunt, an American, who devised a needle with an eye near the point, and used two threads to make a lock stitch. Elias Howe, also an American, reinvented this arrangement in 1834, and, after suffering for some years the neglect which is the fate of most inventors, laid the foundations of the present extensive trade in sewing machines. In all of the many modifications of Howe's device now in use, the needle is fixed to a vertical bar having an up and down motion given to it by a cam, and at each descent it carries the thread, which is passed through an eye near its point, through the fabric to be sewn, and on its ascent the friction between the cloth and the thread causes the latter to be left under the cloth in the form of a loop on one side of the needle, as shown at A in the figure. A boat-shaped shuttle containing a small spool of thread and having a horizontal reciprocating motion is now passed through this loop, so that one thread is twisted half a turn round the other, and the further ascent of the needle draws the threads tight, at the same time pulling the twist into the centre of the fabric. While the needle is at the upper part of its



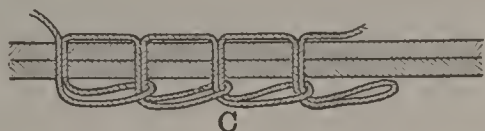
SEWING MACHINE.—
Fig. A.



SEWING MACHINE.—Fig. B.

movement the cloth is advanced by the length of one stitch, and the whole cycle of operations is repeated. This process results in the *lock stitch* shown at B, and forms a very neat and secure seam. The feed mechanism for advancing the cloth between the stitches consists of a small metal block having on its upper surface a series of saw-like teeth, which works neatly under the

needle in a slot in the plate on which cloth rests. The fabric is pressed upon this block by a spring foot, through a hole in which the needle passes. While the needle is descending through the cloth, the feed block is raised and holds it securely while the stitch is being formed; when the needle is clear of the cloth, the block moves forwards through a distance equal to the length of one stitch; it then sinks and moves backwards and upwards to its first position. The *chain stitch* machine is somewhat simpler, as the shuttle and lower thread are dispensed with. A loop is formed on the under-side of the cloth as above described, but on the ascent of the needle this is held by a hook, and the next descent of the needle is made



SEWING MACHINE.—Fig. C.

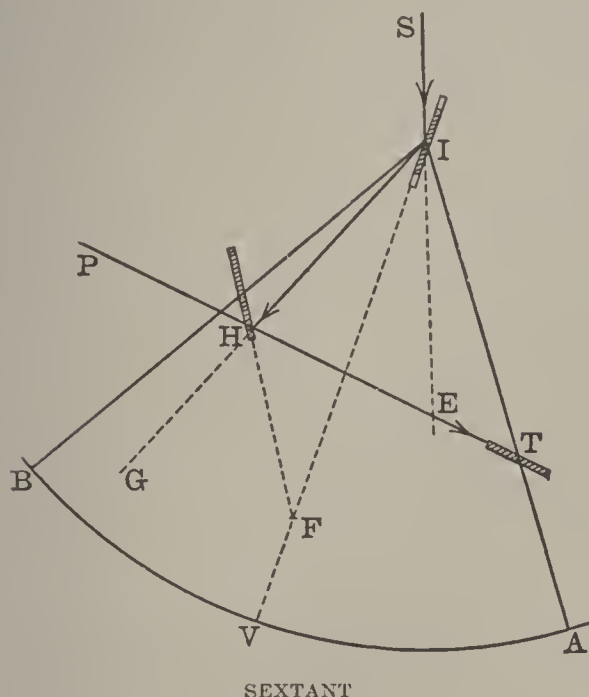
through this loop. The first loop is released from the hook, which engages with the second loop, and on the thread being drawn tight by the rising of the needle, a *crochet stitch* shown at C is formed. This uses more cotton, and is less neat and secure than the *lock stitch*, but the machine is simpler, and therefore cheaper, and may be worked more rapidly than the *lock stitch* machine. About four-fifths of the machines now in use are of the latter kind. Many attachments are sometimes used to facilitate special operations, such as hemming. The adjustments of sewing machines require more care than is usually bestowed upon them; both upper and lower threads are held tight by frictional devices which can be regulated, and it is important that the tensions of the two threads should be equal, and should be suited to the kind of cloth and thread used, in order that a perfect stitch may be made. It is also advisable to proportion the size of the needle to the size of the thread.

Sex, the differentiation of cellular elements, either alone or with other surrounding structures, into male and female, so that their union [REPRODUCTION] results in the stimulus of the latter into a new individual. In its simplest form sex shows itself in the union of similar *gametes*, reproductive cells, that is, incapable by themselves of giving rise to a new organism. Organisms producing such gametes are termed *isogamous*; the union of their gametes, *conjugation*; and its result (among plants at least), a *zygospore*. Such similar gametes may be free-swimming, ciliated, and pear-shaped, or *planogametes*, or without cilia or definite form (*aplanogametes*). Among the Protozoa each organism generally consists of such an undifferentiated conjugating gamete. But little higher in both the algal and the animal series *heterogamy*, or the differentiation of distinctly male and female gametes, arises. The former, the *spermatozoid*, or *sperm-cell*, is generally the smaller and more active, being a well-defined, ciliated, free-swimming mass of protoplasm. This form, it has been suggested, is the result of the excess of katabolism

(q.v.) in a previously undifferentiated amœboid cell, finding its outward expression in increased activity of movement. The female gamete, *oosphere*, *ovum*, or *germ cell*, on the other hand, is generally larger, spherical, unciliated and quiescent, the result of an excess of anabolism, i.e. of potential, rather than of kinetic, energy. The union of such heterogamous elements is termed *fertilisation*. Where male and female organs are borne by the same individual, and on the same branch or body segment, the organism may be termed *monoecious*, the term *hermaphrodite* being unsuitable, as suggesting self-fertilisation. Where male and female organs, though on the same individual, are more distant (as when in distinct flowers), the organism is termed *monœcious*. Where the organs occur on distinct individuals, it is termed *diœcism*, a condition which is the rule among the higher animals more than among the higher plants. It is now recognised that the sex of an embryonic organism is determined by the condition of the parents, as regards relative age, etc., by the quality and quantity of food supplied to the female parent or larvæ, by temperature, and by other similar external conditions. Abundant nourishment tends to produce females; but it is difficult as yet to arrive with certainty at any other law of general application as to sex determination. Among some worms, such as the Rotifera, and some crustaceans, such as the cirripedes, the male becomes degenerated into a mere appendage, or "*complemental male*," borne by the female, and a similar condition occurs in the algal *Edogonium*. Among insects the sexes are most strongly contrasted by *secondary sexual characters*, such as the smaller size, greater activity, brighter colours, and sound-producing powers of the male; whilst among bees, ants, and other Hymenoptera (q.v.), we may almost be said to have more than two sexes. Among mammals, offensive organs, such as horns and tusks, and ornamental appendages, such as manes and colour-patches, often mark the males; but among birds the contrast of sex is yet more striking in the generally gay plumage and nuptial song of the male. Numerous subsidiary sex questions, such as apogamy, parthenogenesis, etc., are treated separately. The advocacy of Charles Darwin gave importance to his theory of *Sexual Selection*, according to which the choice of a mate by the female animal has had much to do with the evolution of secondary sexual characters in the male, such as song, gay plumage, colour, wattles, moustaches, etc. Wallace has argued that this process is entirely controlled by natural selection, and other biologists think the part played by it in the origin of species quite subordinate.

Sextant is an instrument for measuring the angular distance between two objects. The principle underlying its action is illustrated in the accompanying figure. I and H are two mirrors perpendicular to the plane of the paper. Light from a celestial object, S, is reflected at I along I H, and again reflected at H along H T, this direction being the same as that of light from another object, P. If the lines I and H be produced, they meet at

F, S I produced cuts P T at E, and I H is produced to some point, G. The angular distance between P and S is the angle E, and that between the two mirrors is the angle F. It can be shown that $F = \frac{1}{2} E$; for $E = G H E - H I E = 2 G H F - 2 H I F$, since H I E is bisected by I F and G H E by H F. And $F = G H F - H I F \therefore F = \frac{1}{2} E$. In the actual instrument the mirror H is fixed on the arm I B, while I A is another fixed arm, making an angle of 60° with I B. The mirror H is therefore parallel to I A. The arc A B measures 60° , so that the mirror I is at its centre, and is fixed to a movable radius



I V having a vernier at V. The mirror H is only silvered over its lower half, so that the object P is viewed directly through its upper part. The instrument is held so that the object P is seen directly through the telescope T, on the arm I A. I V is then moved until the image of S appears to touch P. The position of V is then noted; this gives the angle V I A, which is equal to H F I (since I A and H F are parallel) and half S E P. It is usual to have the arc A B graduated not in degrees, but in half-degrees, each half-degree being marked at double its value. Thus, if A V be really 20° , it is marked 40° ; hence the readings give at once the angular distance between P and S. The mirror I is usually termed the index-glass, and H the horizon-glass, because, in taking the altitude of any object at sea, the horizon is viewed directly through its upper part. This instrument was devised by Hadley, and it is usually known as Hadley's sextant. It is specially of use in making measurements at sea, since the movement of the ship has no effect on the coincidence of the object and image. For measuring longitude instruments giving an accuracy of a few seconds are employed, the radius being generally about twelve inches.

Sexuality in Plants was suspected by Aristotle and Theophrastus, and was more fully recognised by Pliny, these writers being more or less familiar with the division of sexes in the date-palm; but until the 17th century mere difference

in habit was often taken to indicate sex, as in the familiar case of the so-called male and lady ferns. Clusius (1526-1609), however, terms the staminate papaw the male, and the carpellate the female. Even Cæsalpinus (1519-1603) and Malpighi (1628-94), who traced the development of the embryo, seem ignorant of the function of the pollen. Grew and Ray at least formed conjectures of what we now know to be the truth; but Linnæus and Sachs attribute the demonstration of sex in plants to Camerarius (1665-1721). Further experimental confirmation was given by Bradley (1717), Philip Miller (1751), and Linnæus assumed sexuality in making the sexual organs the basis of his classification. Kölreuter (1733-1806) first studied the artificial production of hybrid plants, and Sprengel (1750-1816) detected the frequent occurrence of dichogamy and the importance of the aid of insects in pollination. After Thomas Andrew Knight, Dean Herbert, and K. F. Gärtner had also shown that "Nature abhors perpetual self-fertilisation," Darwin arrived at the conclusion that cross-fertilisation secures a stronger and more numerous progeny. Schleiden in 1837 first pointed out the general protrusion of pollen-tubes by the pollen-grains and their passage into the micropyle; but not till 1846 was it clearly shown by Amici that the egg-cell is formed in the embryo-sac before fertilisation. Among cryptogams, though conjugation in *Spirogyra* was maintained by Vaucher to be sexual in 1803, and spermatozoids, observed in 1822, had been declared by Unger in 1837 to be male organs, mainly from their resemblance to those of animals, it was not till 1849 that Hofmeister, who did much also to show the absence of spermatozoids in the pollen-tube of the higher plants, gave a complete account of the "alternation of generations" (q.v.) in the higher cryptogams and the fundamental identity of all cases of sexuality as consisting of the fertilisation of a germ-cell by a sperm-cell. It seems that some of the lowest plants (Protophyta) may be destitute of sexuality; whilst in others more highly organised, such as some Saprolegnias and the Basidiomycetes among Fungi, it has been lost by a degeneration-process known as apogamy (q.v.).

Sexual Selection. [SEX.]

Seychelles, a group of eighty islands in the Indian Ocean, 1,000 miles east of Zanzibar. They are of granitic formation with encircling reefs of coral, and rise steeply from the sea. The total area does not exceed 50,000 acres, Mahé, the largest, comprising fully three-fifths of that amount. The vegetation is luxuriant, and though they are only three or four degrees below the equator, the tropical heat is tempered by sea-breezes, and the climate is healthy. All but half a dozen are uninhabited. From 1742 to 1798 they belonged to France, but were conquered by the British, and are now under the government of Mauritius. Almost every tropical product can be raised, but cocoanuts and their oil, with sperm-oil and tortoise-shell are the only exports. the negro population being averse to labour. [COCO DE MER.] Port Victoria, in Mahé, is the chief harbour and the administrative centre.

Seymour, an ancient family named from St. Maur, in Normandy, which in the 14th century had acquired landed estates in Monmouthshire and Somersetshire. SIR JOHN SEYMOUR, who served in Henry VIII.'s French wars, was the father of Queen JANE SEYMOUR, that monarch's third wife and mother of Edward VI. Her elder brother EDWARD, Earl of Hertford, afterwards Duke of Somerset, was made governor of the king and Protector of the realm on the accession of Edward VI., but he was eventually supplanted by John Dudley, Earl of Warwick and Duke of Northumberland, and died on the scaffold in 1552. Jane's younger brother, THOMAS, Lord Seymour of Sudeley, after marrying Katharine Parr, Henry VIII.'s widow, and holding the office of Lord High Admiral, was put to death on a charge of treason in 1549. The Earl of Hertford, eldest son of the first Duke of Somerset by his second marriage, fell into disgrace in Elizabeth's reign in consequence of his marriage with Lady Katharine Grey, sister of Lady Jane Grey (q.v.). The living representative of this branch was in 1660 recognised as Duke of Somerset, but the Protector's descendants by his first marriage recovered the title in 1750. The present Marquis of Hertford and Admiral Beauchamp Seymour, Lord Alcester, who distinguished himself in the bombardment of Alexandria (1882), both belong to the elder branch.

Sforza, a celebrated Italian family, founded by JACOPO SFORZA (1369-1424), the son of a farmer at Cotignola, in the Romagna, who became a famous *condottiere*, and died constable to Joanna II. of Naples. His real name was Muzio Attendolo, which he abandoned for that of Sforza ("stormer"). FRANCESCO SFORZA (1401-66), his natural son, an able tactician and general, at first supported the Duke of Milan against the Venetians and Florentines, but afterwards supported the latter in their struggle with the Milanese. In 1441, however, he married the Duke's only daughter, and on his death in 1447 laid claim to the duchy, which he obtained after three years' hard fighting. Meanwhile he had wrested the March of Ancona from the Pope (1434), and yielded it to him again (1447). He was a wise ruler and a patron of learning, and was much beloved by the Milanese. LODOVICO-MARIA SFORZA, "The Moor" (1451-circa 1510), third son of the preceding, succeeded his brother GALEAZZO and his nephew GIOVANNI-GALEAZZO, the latter of whom he probably poisoned (1494). Whilst Regent, in 1491, he had incited Charles VIII. of France to invade Italy and attack Naples, but he now became alarmed at the success of the French, and joined the league by which Charles was expelled. In 1499 the Milanese were conquered by Louis XII., and in 1500 Lodovico was carried captive to France, where he passed the remainder of his life.

Shad, a common name, with or without an epithet, for several fish of the Herring family, generally ranked with the Herring, but sometimes made a separate genus. They are marine fish, ascending rivers to spawn, depositing their eggs on the bottom. In form and general appearance they

resemble Herrings, but are of larger size. Their flesh is valued for food. The Common or Allice Shad (*C. alosa*) is common on the British coasts and in the estuaries of some of the larger rivers. The Twaite Shad (*C. finta*) is abundant round our coasts, and is found in the Thames. The American Shad (*C. sapidissima*), with an average weight of 4 or 5 lbs., is a valuable food-fish.

Shaddock (*Citrus decumana*), so called from Captain Shaddock, who, at the beginning of the last century, introduced the shrub into the West Indies from China. Like all the orange tribe, it has winged petioles to its large leaves; its shoots are downy, and its smooth, pale yellow, thick-rinded fruit sometimes reaches 20 lbs. in weight. Large specimens are sold in London as *pomelo*s; small ones, as *forbidden fruit*.

Shadow. When light falls upon an opaque body, it cannot traverse the space behind that body, and hence a region of darkness is produced, or the body is said to cast a shadow. If the light came from an absolute point, a projection of the object would be cast upon any surface behind it, the form of the projection depending on the shape of the surface and its position with respect to the object and the light. Usually the light does not emanate from a point, but the source of light has measurable size; in this case each point of light forms its own shadow, and the final result is a number of overlapping shadows, the darkest region being that where most overlapping takes place, and the lightest where least overlapping occurs. A shadow looks darker or lighter according as much or little extraneous light is about, its depth being merely estimated by contrast. If the surface receiving the shadow be near the object, a deeper shadow is obtained than when it is far away, owing to the fact that the rays of light which would be primarily intercepted by the object can, by reflection from other surfaces, etc., find their way into the otherwise dark region, if space enough be allowed for this behaviour.

Shadwell, THOMAS (1640-92), a dramatist of some ability, ridiculed by Dryden as M'Flecknoe in his satire of that name, and as Og in the second part of *Absalom and Achitophel*. The quarrel was caused by the scurrilous tone of *The Medal of John Bayes* (written by Shadwell as a counterblast to *Absalom and Achitophel* and *The Medal*), which satirised the opponents of the Court party. Shadwell succeeded Dryden as laureate in 1688.

Shaftesbury, ANTHONY ASHLEY COOPER, 1ST EARL OF (1621-83), statesman, was the son of Sir John Cooper, of Rockborne, in Hampshire. After studying at Oxford, he entered Parliament in 1640. When the Civil War broke out, he at first supported the Royal cause, but subsequently he went over to the Parliament, and was given the command of the troops in Dorsetshire. He sat in the Barebones and first Protectorate Parliaments, but was excluded by Cromwell from that which met in 1656. He thereupon joined the opposition, and afterwards took a leading part in effecting the Restoration, being one of the twelve commissioners

sent to Breda to invite Charles II. to return. He must be held in some measure responsible for the misdeeds of the Cabal Ministry (1667-73), although he endeavoured to prevent the "stop of the exchequer" (1672), and probably wished to maintain the Triple Alliance. In 1672 he was made Earl of Shaftesbury and Lord Chancellor, but the success of the Test Bill in the following year proved fatal to the Cabal. He now put himself forward as the champion of popular rights, and began to intrigue with Monmouth. In consequence of his opposition to the prorogation of Parliament in 1677 he was placed in the Tower, where he remained for a year. His conduct during the excitement occasioned by the Popish Plot (1678-80) marks him as a reckless and shameless demagogue. Yet England owes him a debt of gratitude for the Habeas Corpus Act, passed after his return to power as President of the Council in 1679. He only held office six months, for his attempt to impeach the Duke of York broke down, and, after his appearance at the Oxford Parliament with an armed body of followers, he was again lodged in the Tower (1681). The bill charging him with high treason was thrown out by the Middlesex Grand Jury, but he had been sinking deeper and deeper into intrigue, and in November, 1682, he prudently fled to Holland. His death took place two months later at Amsterdam. Shaftesbury is the Achitophel of Dryden's satire.

Shaftesbury, ANTHONY ASHLEY COOPER, 3RD EARL OF (1671-1713), philosopher, grandson of the 1st Earl, was born in London and educated at Winchester. After duly performing the grand tour he entered Parliament as Whig member for Poole (1695), but three years later the state of his health forced him to abandon politics. During the remainder of his blameless career, which was early cut short by consumption, he led the easy-going life of an affluent literary philosopher. He died at Naples. The leading idea in his *Characteristicks* (1711) is that the right order of the universe is maintained by means of a due balance between the various parts of which it is composed. So it is also with the individual, who is the subject of various passions, appetites, and affections, and human society holds a middle place between the two, and is regulated by the same law. Thus, for Shaftesbury, morality seems to have occupied much the same sphere as the æsthetic feelings. Whatever transgresses the law of the universe is repugnant to the "moral sense" or "taste," and this is the origin and sanction of our notions of right and wrong.

Shaftesbury, ANTHONY ASHLEY COOPER, 7TH EARL OF (1801-85), philanthropist, was born in London and educated at Harrow and Oxford. His parliamentary career began in 1826, when he was elected Conservative member for Woodstock; he afterwards represented Dorchester (1830-31), Dorsetshire (1833-46), and Bath (1847-51), and held several Government offices prior to his succession to the earldom in 1851. Soon after his entrance into Parliament he showed himself a vigorous opponent of *laissez faire*, and his unwearied

efforts on behalf of the labouring population at last bore fruit in the Act forbidding the employment in mines of women and of boys under thirteen (1842), and another measure, which realised one of his earliest hopes, the Ten Hours' Bill of 1844. Other objects which engaged his active sympathy were the protection of chimney-sweepers' apprentices, in whose favour he obtained an Act of Parliament, the establishment of ragged schools, and the erection of sanitary dwellings for the poor. In his religious views Lord Shaftesbury was an ardent Evangelical. He warmly supported the British and Foreign Bible Society, the London City Mission, and other institutions of a similar character.

Shagreen, (1) the prepared skin of the shark and other fish of the same order which was at one time used as a covering for watch and instrument cases, etc. In this sense the word may also denote the unprepared skin. (2) A kind of leather made from the skin of the horse, the ass, and other animals. Whilst the skin is still moist and soft, a seed belonging to the genus *Chenopodium* is forced down upon it, so that it becomes imbedded in the surface. As soon as the skin is dry, the seeds are removed, and the surface is pared down almost to the level of the cavities they filled. The skin is then soaked in water, the result being that the cavities swell up and produce a blotched appearance.

Shah, the proper title of the king in Persia, Afghanistan, and other states of Southern and Central Asia. A son of the king may also claim the title.

Shah-Jehan (d. 1666), the fifth emperor of the Mogul dynasty, succeeded his father Jahangir, at Delhi, in 1627. After two campaigns against the princes of the Deccan, which resulted in an extension of his dominions, and some unsuccessful efforts to regain Kandahar from the Persians, he fell into the hands of his rebellious son, Aurungzebe, and was imprisoned in the citadel of Agra, where he remained till his death. He was accounted a wise and just ruler. Such buildings as the magnificent Taj Mahal attest his love for architectural display.

Shairp, JOHN CAMPBELL (1819-85), man of letters, was born in Linlithgowshire, and educated at Edinburgh Academy and Glasgow University, whence he proceeded to Balliol College, Oxford. He became professor of humanity at St. Andrews, in 1861, and principal of the United College of St. Salvator and St. Leonard in 1868. From 1877 to his death he was professor of poetry at Oxford. His works include a volume of poems entitled *Kilmahoe* (1864), *Studies in Poetry and Philosophy* (1868), *Culture and Religion* (1870), *Aspects of Poetry* (1881), and *Burns in the English Men of Letters* series (1879).

Shakers, the name usually given to the "United Society of Believers in Christ's Second Appearing," a sect founded by Anne Lee (1736-84), a native of Manchester. Jane Wardlaw, a tailor's

wife, who belonged to the Society of Friends, declared she had received a Divine message announcing that Christ's second coming was about to take place, and that He would assume the form of a woman. Anne Lee applied this prophecy to herself, and gained a few converts besides Jane Wardlaw and her husband. They were called "Shakers," owing to the extravagant gestures they adopted when engaged in worship. In consequence of the persecution to which they were subjected, Anne sailed with her followers to America in 1774, and formed a settlement at Niskayuna (now Watervliet), near Albany, New York. The centre of the society, which adopted communistic ideas, combined with strict celibacy, was afterwards fixed at New Lebanon. The Shaker settlements, of which there are fifteen, comprise both men and women, under the direction of an elder and an elderess. In addition to their own peculiar doctrines regarding marriage and a female incarnation, they share many of the views held by the Quakers. They are a quiet, industrious people, famed for their agricultural skill and their knowledge of medicinal herbs. The *English Shakers* owed their origin to Mary Ann Girling (1827-86), who became a prey to the same kind of delusions as Anne Lee. They formed a settlement in the New Forest, where they suffered great privations, and after the death of Mrs. Girling, whom they regarded as immortal, the community was dissolved.

Shakespeare, WILLIAM (1564-1616), was born at Stratford-on-Avon in April (probably on April 23 Old Style), 1564. His father, John Shakespeare, a fellmonger and glover, who in 1568 became high-bailiff of Stratford, had married in 1557 Mary Arden, daughter of a well-to-do farmer. William Shakespeare was probably educated at the Stratford free school, where he would have learnt some Latin and possibly the rudiments of Greek. When he was about fourteen years old his father fell into pecuniary troubles. There is a tradition that the boy became a butcher's apprentice; it has been conjectured that he was also for a time in an attorney's office, the legal allusions in his writings being unusually numerous and accurate. At the age of 18 and a half he was married to Anne Hathaway, daughter of a yeoman of Shottery in the parish of Stratford; she was eight years older than her husband. A daughter, named Susanna, was baptised on May 26, 1583. His other children were twins, Hamnet and Judith (baptised February 2, 1585); Hamnet died in his twelfth year; Susanna and Judith survived their father.

The tradition that Shakespeare quitted Stratford in consequence of trouble which followed a deer-stealing expedition on the grounds of Sir Thomas Lucy, of Charlcoate, is probably based on fact. The date is perhaps 1586 or 1587. It is said that his first employment in London was that of holding horses at the theatre door; but the statement cannot be proved. We lose sight of him until 1592, when he is referred to in a hostile spirit, as an actor and playwright, by Robert Greene, the dramatist, in the pamphlet *Greene's Groatsworth of Wit*. Chettle, the editor of Greene's deathbed pamphlet, apologises

for the attack, and speaks of Shakespeare's "grace of writing" and "uprightness of dealing." As an actor Shakespeare never became eminent; he is said to have played the ghost in his own *Hamlet*, Old Adam in *As You Like It*, and Old Knowell in Jonson's *Every Man in his Humour*. In 1593 appeared his narrative poem *Venus and Adonis*, dedicated as the "first heir of his invention" to the Earl of Southampton, his friend and patron. It was followed in 1594 by *The Rape of Lucrece*. Both poems were highly popular; the earlier is remarkable for its pictures of country life; the latter for its sympathy with Roman character; the *Venus* is a study of feminine passion and boyish coldness; the *Lucrece* represents wifely chastity and fidelity opposed by the treason and violence of an evil man.

Shakespeare's first work as a dramatic writer (about 1589-90) was probably that of rebandling and fitting to the stage pieces by earlier dramatists. *Titus Andronicus* may have been retouched by him, and it is believed that he made additions (as Act ii. sc. 4) to the *First Part of Henry VI.* In the *Second* and *Third Parts of Henry VI.* he revised the work of Greene and perhaps Marlowe, possibly with Marlowe's assistance. *King Richard III.* shows the influence of Marlowe, though his hand is not present in the work. In the prose passages of the early comedies he was influenced by Lyly. *Love's Labour Lost* satirises contemporary affectations of manners and diction. The farcical *Comedy of Errors* illustrates the influence of Plautus on English comedy. The *Two Gentlemen of Verona*, partly derived from a Spanish source, is a play in the romantic manner. This early group of comedies reaches its highest point in *A Midsummer Night's Dream*, where exquisite lyrical writing, broad humour, and chivalric sentiment are delightfully brought together. *King Richard II.* (about 1594), though not unaffected by Marlowe's *Edward II.*, shows how Shakespeare in historical drama was delivering himself from discipleship to Marlowe. *King John* (about 1595), to some extent founded on an older play, stands as regards style midway between Shakespeare's early histories and those of his maturer years—the two parts of *King Henry IV.* (1597-98) and *King Henry V.* (1599), in which there is a great development of comic power. In like manner the *Merebant of Venice* represents the mid-period between the earliest comedies and those which were produced in the closing years of the 16th century. Shakespeare's earliest independent tragedy is the lyrical tragedy of youth and love and death, *Romeo and Juliet*. Its chief source is Arthur Brooke's narrative poem *Romeus and Juliet* (1562), itself derived from an Italian tale by Bandello. Thus alike in comedy, history, and tragedy Shakespeare was advancing with swift and unfaltering steps. He had learnt all that his dramatic predecessors could teach him, and had formed a style of his own.

Meanwhile, his worldly fortunes prospered. He acted with his company—the Lord Chamberlain's—on several occasions before Queen Elizabeth. In 1597 he purchased "New Place," a large house in Stratford, and he seems to have exerted himself to



SHAKESPEARE.

- 1 The Church, Stratford-on-Avon (Poulton & Son, London, phot.). 2 Shakespeare's House (Harvey Barton, Bristol, phot.).
3 Shakespeare's Monument, Holy Trinity Church, Stratford (Poulton & Son, phot.). 4 Ann Hathaway's Cottage (Harvey Barton, Bristol, phot.).

restore his father's fallen fortunes. In 1598 he assisted in negotiating a loan for the Stratford Corporation. He became a shareholder in the Globe Theatre, erected in 1599 on the Southwark side of the river near London Bridge. In 1602 he enlarged his New Place property, and bought 107 acres of land near Stratford. Three years later he purchased for £440 the unexpired term of a moiety of the Stratford and neighbouring tithes. But as he advanced in life sorrows came to Shakespeare. His son Hamnet died in 1596; his father in 1601; in 1607 he lost his brother Edmund, an actor; in the following year his mother died. The *Sonnets* published in 1609, but probably written several years previously, tell of an idealising friendship for some unknown youth of high station, and of an extravagant passion for some unknown lady, highly accomplished but not beautiful in person, upon whom Shakespeare squandered his heart. She would seem to have ensnared Shakespeare's young friend, with the result that the friendship, though afterwards restored, was broken for a time. The *Sonnets* are dedicated by the bookseller to "Mr. W. H." as their "only begetter." Many conjectures have been hazarded as to the identity of Shakespeare's friend; perhaps the least unfortunate is that which suggests that he was William Herbert, Earl of Pembroke. An attempt has been made to identify the lady of the *Sonnets* with Mary Fitton, a maid of honour to the queen. Some critics argue that "Mr. W. H." was Henry Wriothesley, Earl of Southampton; others regard the veiled story of these poems as wholly fanciful; others as an allegory; but it can hardly be doubted that a basis of fact supports what is ideal or imaginative.

Shakespeare's brightest comedies lie about the year 1600. *The Merry Wives of Windsor* is said to have been hastily written at the request of Queen Elizabeth, who desired to see Falstaff in love. *The Taming of the Shrew*, somewhat boisterous in its mirth, is founded on an older play. In *Much Ado about Nothing*, founded on a story by Bandello, the mirth is refined, and some matter almost tragic is connected with the humour of the piece. *As You Like It*, based on a novel by Lodge (itself derived from the old poem of *Gamelyn*), and *Twelfth Night* brings the development of Elizabeth comedy to its highest point. The gaiety declines in the comedies which immediately succeed; *All's Well that Ends Well* is serious in the presentation of its strong-willed and clear-sighted heroine; *Measure for Measure* is dark, and would be painful but for the nobility of the character of Isabella; *Troilus and Cressida*, the date of which is disputed, is a comedy of disillusion, almost cynical in its satire of spurious heroism and the deceptions of passion. At this point Shakespeare turned from comedy to tragedy. *Julius Caesar* (1601) and *Hamlet* (1602) may be described as tragedies rather of reflection than of passion. In the former Shakespeare follows Plutarch; the latter is perhaps based upon an older play. Each represents, in the persons of Brutus and Hamlet, the inefficiency of a thinker and student for dealing with the tragic material of actual life. Tragedies of passion follow. In *Othello* (about 1604) the fatal breach is between husband

and wife; in *King Lear* (1605) it is between father and child. *Macbeth* (about 1606), the tragedy of guilty ambition, represents the treason of a subject to the king. In *Antony and Cleopatra* (1607) and *Coriolanus* (1608) the poet again handles Roman history; the one is the tragedy of Roman manhood yielding to the seductions of sensual pleasure; the other is that of Roman pride overthrown by its own excess. The heroine of one play exhibits the voluptuous genius of the East; the heroine of the other is the lofty matron of Rome. This group of plays closes with *Timon of Athens* (about 1607-8), which exhibits the ruin of manhood, caused by pessimistic despair following on an over-lax benevolence.

The last group of Shakespeare's plays are romantic, and, though showing a deep knowledge of human ills, are radiantly serene in temper. They tell of the knitting again of broken human ties, of the gentleness and wisdom of old age, the joy of unstained youth, the blessedness of the forgiveness of injuries, and the loveliness of meadow and mountain and sea. Probably only a part of *Pericles* (part of Act iii. and all of iv. and v.) comes from Shakespeare's hand. *Cymbeline* combines a fragment of old British legend with matter from Italian romance. *The Tempest* is like a great mage's legacy of wisdom. In *The Winter's Tale* Shakespeare dramatised a novel by his early contemporary Greene. It is now disputed whether any portion of *King Henry VIII.* belongs to Shakespeare; part of the play is undoubtedly by Fletcher. The authorship of *The Two Noble Kinsmen* is also uncertain; but possibly in it, as in *Henry VIII.*, Fletcher co-operated with Shakespeare.

We do not know that Shakespeare appeared as an actor after 1603 or 1604. In 1607 his daughter Susanna married a Stratford physician named Hall. The shares in the Globe Theatre were sold, but Shakespeare, while retiring to his native place, retained a connection with London, having bought in 1613 a house near Blackfriars Theatre. In February, 1616, his daughter Judith married Thomas Quiney, a Stratford vintner. A month later the great poet was seriously ill, and attached his signature to a draft copy of his will. He died April 23, 1616, and his body was laid in the chancel of the parish church. His widow lived until 1623. The only indisputably genuine portraits of Shakespeare are the rudely-executed bust in the church at Stratford and the rude engraving by Droeshout in the first collected text of his plays (1623). The form "Shakspeare" has autograph authority; "Shakespeare" is the form which appears on title-pages of books for the publication of which the poet is responsible.

Shale, a laminated sedimentary rock, typically argillaceous, but often either sandy, calcareous, carbonaceous, or bituminous. Shales split into very thin laminae parallel with the bedding of the rock. They may be the result of separate acts of intermittent deposition, as in the inundation-mud of the Nile, and are often indications of shallow waters with varying sediments, as in the paper-shales and associated beds of the Penarth (Rhætic)

series. They thus frequently mark transitions to pure sandstones or limestones, as in the Ledbury Shales (sandy) below the Old Red Sandstone and the Tuedian, or Lower Limestone Shale below the Carboniferous Limestone. Most Palæozoic argillaceous beds are shales, as in the Wenlock and Ludlow Shales, probably the result of the vertical pressure from the weight of superincumbent rock. The roof of most coal-seams is formed of shale (the "slate" of our coal-scuttles). Bituminous shales, from which paraffin is distilled, as in Lanarkshire, are recognisable by smell, by brown stains on a black surface, and by rolling up when pared.

Shallot (*Allium ascalonicum*), a hardy perennial species of onion, native of Palestine, and especially of the neighbourhood of Ascalon, of which its name is a corruption. It was introduced into England in 1548, and is milder in flavour than the onion. Its bulbs divide into "cloves," as in garlic. They are largely pickled in vinegar.

Shammai, a Jewish rabbi who lived in the time of Herod, and founded a school which entered into rivalry with that of Hillel (q.v.), though the two contemporaries do not seem to have differed greatly in their doctrines. Shammai interpreted the law in a very literal manner, and enjoined a strict observance of all its ordinances.

Shamrock, a green trefoil leaf serving as the national emblem of Ireland, having been used by St. Patrick to illustrate the doctrine of the Trinity. The plant in question was probably not the wood-sorrel, which is comparatively uncommon in Ireland, but a true trefoil, such as *Trifolium repens*, *T. filiforme* or *Medicago lupulina*, which are worn indiscriminately in Ireland on St. Patrick's Day.

Shamyl (d. 1871), a Circassian chieftain, born in Daghestan, who became the spiritual and temporal leader of his countrymen in their long resistance to Russian aggression. After more than one extraordinary escape, he was captured in 1859, and from that time to 1870 lived at Kaluga, in Russia. The year before his death he removed to Mecca, in Arabia.

Shanghai, or SHANGHAE, a city and port of China, on the Hwang-p'u or Woosung river, 12 miles above its junction with the Yang-tsze-Kiang. Surrounded by walls $3\frac{1}{2}$ miles in circumference, it is a poorly-built and dirty place, but its situation makes it the outlet of the products of Central China, and in 1842 it became a treaty port. Immediately to the N. of the walls lies the European settlement, the French and English quarters being separated from the American by the Soochow Creek. Here a fine modern town has sprung up, with a broad promenade along the quay, a Gothic cathedral, municipal buildings, club-house, hospitals, etc. After the seizure of the city by the Taeping rebels in 1852, the customs were handed over to the management of the foreign consuls, and this system was extended to all the treaty ports.

Shannon, THE, rises in the Cuileagh Mountain, County Cavan, and after a south-westerly course of

254 miles, empties itself into the Atlantic, between Loop Head and Kerry Head. It forms the boundary between Connaught W. and Leinster and Munster E., flows through Loughs Allen, Baffin, Rea, and Derg; has on its banks the towns of Limerick, Killaloe, and Athlone, and is navigable for about 214 miles, though large vessels cannot get higher than Limerick.

Shark, a common name for any fish of the group Selachoides [FISHES], widely distributed, but most numerous between the tropics. The body is long and cylindrical, with a pointed snout, and strong flexible tail, the latter forming an admirable swimming organ. In the place of scales the skin is covered with calcified papillæ; the teeth are well developed in most forms, though in some they are adapted for crushing rather than cutting, and these sharks feed only on small fish or on molluscs and crustaceans. In most the eggs are enclosed in a horny case, though some bring forth the young alive. In India and China the collecting of sharks' fins is an important industry. They are used for making a thick gelatinous soup. In Ceylon a shark fishery is carried on, and oil is expressed from the livers. The skin is also utilised for shagreen. Dr. Günther (*Introduction to the Study of Fishes*) recognises the following families:—

CARCHARIIDÆ, chiefly from tropical seas. The Blue Shark (*C. glaucus*) and the White Shark (*C. vulgaris*) attain a length of from 12 to 15 feet and 20 to 25 feet respectively. [DOGFISH, HAMMERHEAD.]

LAMNIDÆ, containing large pelagic forms. To this family belongs the Man-eating Shark (*Carcharodon carcharias*), which has been known to attain a length of 40 feet. The *Challenger* Expedition obtained from the ooze teeth similar to but twice as large as those of this species, so that the larger form must have become extinct within recent times. [BASKING SHARK, FOX-SHARK, PORBEAGLE.]

NOTIDANÆ, from tropical and sub-tropical seas. About 15 feet seems to be the greatest length.

SCYLLIDÆ. [DOGFISH.]

CESTRACIONTIDÆ.—There are four species of a single genus (*Cestracion*). None exceeds 5 feet in length. The teeth are broad and pad-like.

SPINACIDÆ.—Here belong the Spiny Dogfishes [DOGFISH], and the Greenland Shark (*Lemargus borealis*), which grows to a length of about 15 feet, and is a persistent foe of the whale. The Spiny Shark (*Echinorhinus spinosus*), a Mediterranean ground shark, has the skin covered with spiny tubercles.

RHINIDÆ. [MONK-FISH.]

PRISTIOPHORIDÆ.—This family contains forms like small sawfishes, but with lateral gill slits, and two long tentacles at the base of the saw.

Sharp, GRANVILLE (1734–1813), abolitionist, was born at Durham. In 1772 he interested himself on behalf of the negro Somerset, and obtained from the judges a decision which established the freedom of slaves who escaped to England. He took part with Clarkson in instituting the Association for the Abolition of Negro Slavery, and was also one of the founders of the Bible Society.

Sharp, JAMES (1618–79), Archbishop of St. Andrews, was born in the castle of Banff. During the Commonwealth he supported the "Resolutioners" against the "Protesters," or extreme party, in the Kirk, but when sent on a mission to Charles at Breda (1660) he made use of the opportunity to intrigue with the prince and Clarendon. After the

Restoration he secretly aided the establishment of Episcopacy in Scotland, receiving as his reward the Archbishopric of St. Andrews. By this step, as well as his subsequent conduct, he earned the hatred and scorn of the Covenanters. In May, 1679, whilst he was returning to St. Andrews with his daughter, he was attacked and murdered by twelve men on a lonely spot called Magus Muir.

Shawl (Persian *shāl*), a square or oblong garment worn so as to hang from the shoulders. In the East, where its use dates back to a remote period, it is both worn loose and woven into tunics and other shaped articles. The most beautiful and costly shawls are those made in Kashmir. The material of Cashmere shawls, called "pashm" or "pashmina," is the fine short under-wool of the shawl-goat indigenous to the highlands of Tibet. These shawls are either woven at the loom or embroidered; in the former case they usually consist of small segments joined together with so much neatness that they present the appearance of a single piece; the embroidered shawls have an intricate design worked with the needle in pashmina thread on a plain ground of the same material. The processes of sorting the wool, spinning, dyeing, and weaving or embroidering, all require great care and occupy much time. The main feature in the designs on Cashmere shawls, the artistic value of which is fully recognised, is the "cone" pattern, traced by some experts to the image of a cypress bent by the wind. These shawls are also prized for the harmony, depth, richness, and durability of their colours. An inferior kind of shawl, in which the pashm is mingled with "koork" (goat's wool from Kerman, in Persia), is manufactured by settlers from Kashmir in various towns of the Punjab. The genuine Persian shawls are made of silk, and rank second to those of Kashmir alone. The manufacture of imitation shawls which formerly thrived at Lyons, Norwich, Paisley, and elsewhere, has now greatly declined, or become altogether extinct, and it is said that even in Persia European broadcloth is gradually superseding the native shawl-stuff.

Shawnees, North American aborigines, members of the Algonquian family, formerly very powerful on the eastern slopes of the Alleghanies, in the Susquehanna basin, and as far as the Delaware. The famous chief Tecumseh, who endeavoured to rally the Indians against the whites in 1811, was a Shawnee. After his defeat by General Harrison at Tippecanoe, the nation was driven beyond the Mississippi, and was later removed to the Quapaw, Sac and Fox, and Cherokee reserves in Indian Territory. Here the various groups still numbered 1,560 in 1890.

Shearwater, any bird of the genus *Puffinus* of the Petrel family, with about twenty species, universally distributed. The wings are long and pointed; the nostrils open separately; the three front toes are webbed, and the hind toe is very small. All the species are oceanic, and swim well, though they rarely dive, feeding on fish that frequent the surface. Some are nocturnal in habit,

or partially so. Four species visit Britain: the Great Shearwater (*P. major*) is generally met with on the south coast, the Dusky Shearwater (*P. griseus*) has been taken there, and also on the east coast; the Dusky Shearwater (*P. obscurus*) is but an occasional visitor. The Manx Shearwater (*P. anglorum*), by far the commonest, is about the size of a pigeon, black above and white below. It breeds in Wales and in the Orkneys. All these birds lay a single white egg in a hole in the ground.

Sheave. [PULLEY.]

Sheep, a book-name for any individual of a genus (*Ovis*) of Hollow-horned Ruminants, closely allied to the Goats, from which they are distinguished by their convex spiral horns, beardless chin, the presence of sub-orbital glands and tear-pits, and of foot-glands in the hind as well as in the fore feet. Neither canines nor upper incisors are present. The male is called a *ram*, the female a *ewe*; the young are *lambs*, and their flesh is *lamb*; that of sheep is *mutton*. There are about a dozen species, chiefly Palæarctic, but ranging into the neighbouring parts of the Oriental region, and the Rocky Mountain Sheep (q.v.) is American. Central Asia is the chief home of Wild Sheep [ARGALI], whence they range to Northern India, eastward to Tibet, westward to Asia Minor, and northwards to Kanitchatka. There is one African species, the Aoudad (q.v.). Europe has two:—the Mouflon (*O. musimon*) from Corsica and Sardinia, and *O. ophion* almost extinct, from Cyprus. All frequent high and rocky ground, and are gregarious, a habit which subsists in the domestic species. The flocks are generally composed of females and young males, the older males usually living apart at a higher elevation. While the flock is feeding, sentinels are posted, and these give notice of the approach of danger by a sharp whistling sound, and then safety is sought in flight. At certain seasons desperate encounters take place between the males, which fight, as do those of the domestic species, by butting with the head. An old ram is a match for almost any dog. It has been suggested that a dog which had developed the bad habit of worrying sheep should be shut up in a loose box with a sturdy ram, and that a few days of such confinement would probably cure him of any taste for mutton. No doubt the plan would answer except in the case of a bulldog, which would pin the ram by the nose and so prevent its butting. The Common Sheep (*O. aries*) was probably the first animal domesticated by pastoral man, and its origin is as obscure as that of the dog. We find it mentioned, however, in the oldest literature that has come down to us; and the story of Cain and Abel—the tiller of the ground and the keeper of sheep—deals with an early stage of human culture. The sheep has been introduced from Europe into America and Australia, and is now found wherever farming is carried on, though it attains its best development of flesh and fleece in the temperate regions of both hemispheres. In the wild sheep there is a short underwool beneath the straight hairy coat, though this generally is as rough on the surface as the wool itself and

consequently felts. In the domestic sheep the outer clothing of hair is lost, and the underclothing of wool greatly developed. This is shorn yearly, generally in early summer, though the operation may be deferred till the middle of July, and in the autumn "dips" are applied to keep the sheep from parasites and promote the growth of the wool. Sheep, like other domestic animals, have varied greatly. In the Highland and smaller Welsh Black-faced sheep both sexes bear horns, as do the Dorset sheep, though in the last-named breed the horns are small. In the Merinos, noted for their fleece, only the rams are horned. Most of the English breeds are hornless. In the Iceland sheep as many as eight horns are sometimes developed. An Asian breed, found also in Africa, has the tail greatly enlarged by fat, so that it often weighs from 70 to 80 lbs., and is supported by a kind of sledge; while in a Tartar breed the tendency to lay on fat is confined to the rump. The economic value of sheep is very great; their flesh serves for food; their fleeces are made into clothing; their skin into leather for bookbinding and gloves; cheese (*e.g.* the well-known "Roquefort") is manufactured in some countries from ewe-milk; the fat is melted into tallow; from the intestines "catgut" is made; and horns, hoofs, and bones are also turned to some account.

Sheep-Dog, a somewhat loose name for dogs used by shepherds and drovers. In the north the collie is the sheep-dog; in the south this breed is replaced by one more stoutly built and with a stiffer coat, probably due to an infusion of mastiff blood. The Bob-tailed Sheep-dog, with grey curly coat, is sufficiently defined by its name.

Sheerness, a port on the N.W. of the Isle of Sheppey, Kent, 52 miles from London, at the point of junction between the Medway and the Thames. Here a fort was built after the Restoration, but was taken by De Ruyter in 1667. It was afterwards strengthened and a dockyard begun; but the existing basins date from 1830, and, though covering 60 acres, will not accommodate vessels of the largest class. The fortifications are very strong, and the abbey-church is the oldest in England.

Sheffield, a municipal and parliamentary borough in the West Riding of Yorkshire, 39 miles S. of Leeds and 37 miles S.E. of Manchester, with stations on the Midland, Great Northern, and other railways. Since the time of Chaucer it has been the chief seat of the cutlery trade, and the Cutlers' Company was incorporated in 1624. In later years the manufacture of heavier steel goods has been developed, and armour-plates, shot and shell, castings for engines, rails, etc., are turned out in large quantities. Stoves, grates, plated goods, and optical instruments are important products. Among modern buildings are the Town Hall, Cutlers' Hall, Ruskin Museum, and Mappin Art Gallery. The town and suburbs are divided into five electoral districts, each returning a member to Parliament.

Sheil, RICHARD LALOR (1791-1851), Irish politician and orator, was born at Drumdowney,

County Tipperary, his father being a wealthy Cadiz merchant, and educated at Stonyhurst and Trinity College, Dublin. He was called to the Irish bar in 1814, but supported himself mainly by literature, writing several plays, which appeared on the London stage, and contributing *Sketches of the Irish Bar* to the *New Monthly Magazine* (1822). The foundation of the Catholic Association in 1823 opened a new career for him, and when it was suppressed (1825) he devoted himself with energy to the organisation of the society which took its place. By means of his impassioned oratory he gained a position in the movement second to that of O'Connell alone. He eventually joined O'Connell in his demand for repeal, although after Catholic emancipation (1829) he had discountenanced further agitation. From the final defeat of the repeal party in 1834 Sheil acted with the Whigs, and in 1839 he was made Vice-President of the Board of Trade. His death occurred at Florence, where he was residing as British Minister.

Shekel, originally a Jewish weight, and afterwards a gold and silver coin adapted in some manner to the purposes of exchange, although it bore no impression. The Hebrew talent (*kikkar*) contained 60 maneh, and there were 50 shekels in a maneh. The Maccabees were the first Jewish rulers to issue money in the strict sense of the word. Their silver shekels weighed about 220 grains troy, and were worth a little more than two shillings.

Shelburne, WILLIAM PETTY, EARL OF (1737-1805), was descended on his father's side from the ancient Irish family of Fitzmaurice, and through his mother from the celebrated Sir William Petty (q.v.). After serving in the army he entered Parliament (1761), and in 1762 succeeded his father, the first Earl. He at first supported Bute, but subsequently joined the Opposition under Pitt, and, after the fall of the Rockingham Ministry, was made Secretary of State. This office he retained till 1768. He vigorously opposed Lord North's policy in regard both to Wilkes and the American colonies, and on his retirement (1782) accepted the office of Home Secretary in the second Rockingham Administration. Shelburne succeeded the Marquis as Prime Minister, but he was deserted by Fox, who united with North to form the Coalition, and, after seven months' tenure of power, he was forced to resign. In 1784 he was made Marquis of Lansdowne. During the remainder of his life he took little part in politics. He is said to have been the first British statesman who advocated Free Trade.

Sheldrake, any bird of the genus *Tadorna*, of the Duck family, with seven species, from the Palearctic and Australian regions. The hind-toe is free, and in the male there is a frontal knob at the base of the bill. The Common Sheldrake (*T. cornuta* or *rulpanser*) is one of the most beautiful of the family. The head and neck are dark glossy green; this colouring is separated by a white collar from a broad band of bright bay, and the rest of the plumage is black and white, with some grey. The speculum is a rich bronze-green. The male is

about 2 feet long; the female is somewhat smaller, and has the colour less brilliant. It is found on sandy coasts in Britain, and usually nests in a rabbit-hole, whence its local name Burrow-duck. The Ruddy Sheldrake (*T. rutila*) is a rare visitor.

Shell, a hollow projectile within which is placed a bursting-charge of gunpowder or other explosive material, furnished with a fuse to ignite it at the moment desired. Shells are said to have been first employed by the Sultan of Gujerat in the latter part of the 15th century. They are commonly made of cast-iron or steel. The original type, which survives in the *common shell*, was spherical, being fired from a mortar or smooth-bore cannon, and was invariably filled with powder. *Shrapnel shells*, invented by Colonel Henry Shrapnel, R.A. (d. 1842), are filled with bullets and a small bursting-charge of sufficient power to split the shell without impeding the flight of the bullets, which then spread over a wide area, their speed remaining unaltered. The Shrapnel shell, being now used for rifle guns, is elongated in form. *Palliser shells* have sharp-pointed heads which are almost solid, and become chilled by being cast in iron moulds, the result being that their hardness enables them to pierce ships' armour to a very great depth; the explosion takes place without the use of fuses.

Shellac. [LAC.]

Shelley, PERCY BYSSHE (1792-1822), poet, essayist, and reformer, was the eldest son of Mr. (afterwards Sir) Thomas Shelley, of Field Place, near Horsham. Here, on the 4th August, 1792, he was born. His education began, at the age of six, at a day-school at Warnham, and was continued at Sion House, Brentford, then at Eton, and finally at University College, Oxford, whence, in March, 1811, he was expelled for having circulated a tract on *The Necessity of Atheism*. A few months later he eloped with a schoolfellow of his sister's, Harriet Westbrook, with the result that his allowance from his father was stopped, to his great inconvenience. About this time he came under the influence of the writings of Godwin, and entered into a correspondence with that philosopher. Becoming enthusiastic in the cause of Catholic Emancipation and of Repeal, he wrote an address to the Irish people, and in 1812, accompanied by his wife, went to Dublin, and there published it. Under the insistent persuasion of Godwin he abandoned this crusade, and on leaving Ireland he and his wife stayed for a while in Wales and Devonshire. His behaviour while at Lynmouth in disseminating revolutionary publications was brought to the notice of the Government, and, after printing at Barnstaple *A Letter to Lord Ellenborough* asserting the liberty of the press, he returned to Wales. In 1813 his first notable poem, *Queen Mab*, was privately printed. Soon after this, his marriage with Harriet Westbrook having been prompted by chivalry rather than any warmer feeling, he fell in love with Mary Godwin, daughter of the philosopher, herself a person of remarkable literary gifts, who in 1816 wrote *Frankenstein*, and survived to edit Shelley's

Poems (1839) and *Letters* (1840). In 1814 he made provision for his wife's maintenance and left her, and went with Mary Godwin to the Continent. Lamentable as was this step in a moral sense, the development of Shelley's poetical genius was unquestionably a consequence of it. Early in 1815 his grandfather, Sir Bysshe Shelley, died, and, as the heir to the title and the property, he now received a suitable allowance from his father, of which he set apart a fair proportion for his wife. In the following year (1816) he published *Alastor, or the Spirit of Solitude, etc.*; and on his return from a second Continental trip with Mary, during which they were much with Byron, they settled at Marlow, where they for the most part lived during the rest of his life in this country. In November of 1816 his wife drowned herself, and a month later, at the instance of Godwin, he legalised his relation with Mary. In 1817 the *Hymn to Intellectual Beauty* appeared, and in 1818 *The Revolt of Islam*. Early in the latter year he and his family removed to Italy. He now set to work upon *Prometheus Unbound*, completed *Rosalind and Helen*, and wrote his *Julian and Maddalo* and other pieces. His tragedy, *The Cenci*, belongs to 1819, as do *The Mask of Anarchy* and *Peter Bell the Third*. In 1820 appeared *Prometheus Unbound* and *Edipus Tyrannus*, while *The Witch of Atlas* was written. In 1821 came *Epipsychidion*, *Adonais*—a lament for Keats—and *Hellas*. The poet, splendid as had been his achievements, seemed hardly yet to have reached the full measure of his greatness; but in 1822, when he was only in his thirtieth year, his career was brought to an untimely and tragical close. He and his friend Edward Williams, with a sailor-lad, were returning from Leghorn to Lerici in a cutter belonging to himself and Williams, when they were caught in a squall, and all three were drowned. After a time the remains were recovered, and on August 16th Shelley's body was cremated, his ashes being subsequently buried in the Protestant cemetery at Rome. By Harriet he had two children, and by Mary three, the youngest of whom, Percy Florence, became third baronet, and survived till 1889. Among Shelley's more notable contributions to prose are a translation of Plato's *Banquet* and *The Defence of Poetry*. As a reformer he has, in spite of an ardour passionate almost beyond example, exercised little influence, for he was neither practical on the one hand, nor had he philosophic insight on the other. But as a poet, good cause might be shown for placing him next after Shakespeare and Milton. If to most of his creations there is a faintness of outline which makes them hard reading for those who lack the poetic temperament, it is still true that in sheer inspiration, in rapture and exaltation, he ranks with, if not before, the very greatest of our poets.

Shenstone, WILLIAM (1714-63), poet, was born on his father's estate, the Leasowes, at Halesowen, in Worcestershire, and educated at Pembroke College, Oxford. After his father's death in 1745 he lived quietly at the Leasowes, devoting himself zealously to landscape-gardening. His *Elegies*,

which are graceful, though tedious. fascinated Burns; but it is mainly by the *Pastoral Ballads* and the *Village Schoolmistress* (1742) that he has secured a permanent place in literature. Their simplicity of diction and directness of sentiment contrast strongly with the artificiality of contemporary verse.

Shepherd's-purse (*Capsella Bursa-pastoris*), a cruciferous weed, native to Europe, which has spread all over the world. It has a rosette of radical leaves and an elongating, corymbose, lax-erect raceme of minute white flowers, which are followed by the heart-shaped, angustisept siliquas, the septum of which bears numerous yellow seeds. It is also known as "pickpocket," perhaps from behaving as a noxious weed on good soil, and as "pick-your-mother's-heart-out."

Sheppard, JACK (1702-24), a notorious criminal, born at Stepney. He abandoned the peaceful trade of a carpenter for the more exciting allurements of highway robbery, but, after several bold escapes from prison, was hanged at Tyburn.

Sheppey, THE ISLE OF, in the N. of Kent, is separated from the mainland by the Swale and the estuary of the Medway, and has an area of some 30,000 acres, including water, with a length of 9 and a breadth of 5 miles. Marshy to the S., it rises to the height of 60 or 80 feet to the N.; and the soil, consisting wholly of London Clay, is fertile and yields good corn-crops, besides pasturing large flocks of sheep. Sheerness (q.v.) is at its N.E. extremity.

Sherborne, or SHERBOURNE, a market-town of Dorsetshire on the river Yeo, 6 miles from Yeovil. In Saxon times it was the capital of Wessex and the seat of a bishopric. A great Benedictine abbey was founded here, and the fine Norman minster serves as a parish church. The grammar school, founded in 1550, is a flourishing institution. Silk-throwing and glove-making are the chief industries.

Sherbrooke, ROBERT LOWE, VISCOUNT (1811-92), was born at Bingham rectory, Notts, and received his education at Winchester and University College, Oxford. For some years he was a famous private "coach" in that university, but from 1843 to 1851 he was in Australia, where he at first practised at the bar, and afterwards took a prominent part in political life. In 1852 he entered Parliament as an independent member, and after holding various minor offices became Paymaster-General under Lord Palmerston. He was Vice-President of the Council on Education from 1859 to 1864, and introduced the Revised Code of 1860, which arranged for payment by results. As leader of the "Adullamites" and still more by his articles in the *Times* he was influential in causing the rejection of the Reform Bill of 1866. After aiding in the disestablishment of the Irish Church, he became Chancellor of the Exchequer under Mr. Gladstone in 1868, removing to the Home Office in 1873. In 1880 he was raised to the peerage. His *Poems of a Life* appeared in 1885.

Sheridan, RICHARD BRINSLEY BUTLER (1751-1816), dramatist, orator, and politician, was born at Dublin on the 30th September, 1751, son of Thomas Sheridan, actor and lexicographer, and grandson of Dr. Sheridan, the friend of Swift. He was educated in a school at Dublin, and afterwards at Harrow. His first notable dramatic achievement was *The Rivals*, which appeared with great éclat in 1775, and was followed by the farce *St. Patrick's Day*, and this by the opera *The Duenna*, a brilliant success. In 1776 he acquired a share in Drury Lane Theatre. Here, in 1777, he produced the *Trip to Scarborough*, adapted from Vanbrugh's *Relapse*, and his finest comedy, *The School for Scandal*. Here, too, was recited, in 1779, his *Monody to the Memory of Garrick*. In the same year he wrote his last original play, *The Critic*. By the influence of Fox he was elected for Stafford in 1780, and two years later entered the Rockingham Ministry as Under-Secretary of State, retiring with his friend Fox, and in 1783 becoming Secretary to the Treasury in the short-lived Coalition Ministry. Many years later—in 1806—he became Treasurer of the Navy; but he had little capacity for office, and his parliamentary gifts found more appropriate exercise during the long spell of opposition between the Coalition Ministry and the Fox and Grenville Administration. His "Begum" speech, delivered in 1787 in the impeachment of Warren Hastings, was declared by so unsympathetic an auditor as Pitt to have "surpassed all the eloquence of ancient and modern times." In the rupture between Fox and Burke, Sheridan remained faithful to the former. A strong advocate of the Prince of Wales's cause in the Regency debates in 1789, he became the Prince's boon companion, and his indefensible action in connection with Prince George in 1810 deprived him of the confidence of the other Whig leaders, and virtually marks the close of his political career. Always reckless and extravagant, he was often in pecuniary difficulties; and at last, by the burning down of Drury Lane Theatre in 1809, followed by expensive elections, he was reduced to poverty, the last four years of his life, when, having lost his seat, he was no longer safe from the bailiffs, being spent in attempts to evade his creditors. He died on the 17th of July, 1816, and was buried with great pomp in Westminster Abbey. He was twice married—first to Eliza Linley, a vocalist, with whom he ran away; afterwards (in 1795) to Miss Ogle, daughter of a Dean of Winchester.

Sheriff is the chief officer of the Crown in every county in England. He does all the sovereign's business in the county, the Crown by letters patent committing the custody of the county to him. The judges, together with the other great officers and privy councillors, meet in the Exchequer on the morrow (November 12) of St. Martin yearly, and then and there the judges propose three persons from each county to be reported, if approved of, to the Queen, who afterwards appoints one of them to be sheriff, and such appointment generally takes place about the end of the following Hilary Term. If a sheriff die during his term of office, the

appointment of another is the mere act of the Crown. The duties of a sheriff in England are chiefly ministerial, *i.e.* the execution of writs and orders of the courts, though he has a judicial office in the assessment of damages with the assistance of a jury, where judgment has gone by default against a defendant in the superior courts. But in Scotland the sheriff is the chief judge of the county, his civil jurisdiction extending to all personal actions on contract, bond, or obligation to the greatest extent, also by a statute of the present reign to actions relating to a heritable right where the value of the subject matter does not exceed £50 per annum or £1,000 value and to all possessory actions as removings, spuilzies, etc., to all briefs issuing from Chancery in Scotland, as of inquest, terce division, tutory, etc., and generally to all civil matters not specially committed to other courts. He has also a summary jurisdiction in regard to small debts as well as a criminal jurisdiction.

Sherlock, WILLIAM (1641-1707), divine and controversial writer, became Master of the Temple in 1684, and Dean of St. Paul's in 1691. His *Practical Treatise concerning Death* (1689) was at one time very popular. His son, THOMAS SHERLOCK (1678-1761), succeeded him as Master of the Temple, and after various preferments was made Bishop of London in 1738. He published treatises against Bishop Hoadley and the deists Collins and Woolston, also four volumes of *Sermons*.

Sherman, WILLIAM TECUMSEH (1820-91), American general, was born in Lancaster, Ohio. On the outbreak of the Civil War he entered the Northern Army, and distinguished himself under Grant at Shiloh (April, 1862) and Chattanooga (November, 1863). Appointed to the command of the south-western division in March, 1864, he proceeded to operate against General J. E. Johnston, the chief point of his attack being Atlanta in Georgia. As long as Johnston remained in command he was baffled by his skill in manœuvring, but when he was superseded by Hood a series of battles ensued, in which the Confederates were invariably beaten, and in September Atlanta surrendered. On November 16th he set out on his famous march to the sea, which occupied 28 days and was followed by the fall of Savannah. In the early months of 1865 Sherman gained numerous successes in the Carolinas, and on April 26 the Confederate army under Johnston surrendered at Durham Station. When Grant became President he was appointed General and Commander-in-Chief (1869), but in 1874 he retired at his own request.

Sherry, the English name of a Spanish wine which is made from grapes grown in the neighbourhood of Xeres de la Frontera, Andalusia. The qualities of the wine, which is made both from white and red grapes, are owing to the nature of the soil, which is composed of carbonate of lime, magnesia, clay, and silex. The grapes, after drying, are placed in vats and covered with a layer of gypsum, and then trodden. The wine is allowed to ferment for a couple of months, is then racked off, and that which is intended for exportation

is fortified with brandy. Sherry is at its best after fifteen or twenty years in bottle. The wine owes its nutty flavour to an admixture of bitter almonds. The best sherry is Amontillado, the supply being limited by the small district which possesses the suitable soil. Cadiz is the principal seat of exportation.

Shetland Islands, THE, make up with the Orkney group, from which they are separated by a channel, 48 miles in width, the most northern county of Scotland. They number about 100, but only 29 are inhabited, the largest being Mainland, on which is Lerwick the capital, Yell, Unst, Fetlar, Whalsay, and Bressay. The total area is 325 square miles, and most of the surface consists of utterly bare moorland and rock, the coast presenting a rugged and indented outline. Patches of barley, oats, roots, and potatoes are grown; but the breeding of ponies, cattle, and sheep is the chief agricultural resource. More important still is the herring-fishery, in which nearly the whole male population engages. The county returns one member to Parliament.

Shibboleth has come to mean a party cry or watchword. It owes its origin as such to a passage in the Bible (Judges xii. 6) describing the war between Jephthah and the Ephraimites. When the latter tried to escape over the Jordan Jephthah's men intercepted them at the ford, and gave all passers the word Shibboleth to pronounce as a test. The Ephraimite would say Sibboleth and thus betray his nationality.

Shield, an article of personal defence or armour which was used from very ancient times. The *elypeus* of classic times was made of metal, and was round in shape; the *scutum* was oblong, and generally of wood covered with skin, and was often convex; the *parma* was of skin; and the *pelta* crescent-shaped. The Norman shield was triangular, becoming at a later period heart-shaped. The Bayeux Tapestry and brasses of different dates show us the modifications of the mediæval shield. The introduction of fire-arms did away with the necessity for its use in warfare, and new methods of fencing rendered it obsolete in personal combat. The Highlander retained his targe till a late period. The Zulu warrior uses a shield of hide which is impervious to the assegai.

Shield, WILLIAM (1748-1829), a musical composer, born at Swalwell in Durham. He began life as a boat-builder's apprentice, but after the production of his comic opera *The Flitch of Bacon* (1778) he was appointed composer to Covent Garden. He published several other dramatic works, but his fame is based chiefly on his admirable songs.

Shields, NORTH, a port on the N. bank of the Tyne near its mouth. It adjoins Tynemouth, and forms part of that parliamentary borough. The harbour does a large trade in coal, receiving imports also from the Baltic, America, and Italy. Ship-building and the making of chains, anchors, ropes, etc., are the chief industries. There are also salt-works and glass factories.

Shields, SOUTH, on the opposite bank of the Tyne, is a much larger town. It possesses extensive docks, and the entrance to the port is protected by fine piers. Upwards of a million tons of coal are shipped annually, and there is a large general trade. Marine engines, chemicals, glass, and pottery are among the principal manufactures. The borough returns one member to Parliament.

Shilling, as an English silver coin, dates from Henry VII. The present shilling is the twentieth of a pound sterling, and is equivalent to 12 pence, and approximately to 25 cents American, 1.25 francs French, and 1.11 marks German. It contains 87.272 grains silver, of a fineness of .925, the remainder consisting of copper alloy.

Shingle, a kind of detritus worn by water, a little coarser than gravel (q.v.).

Shingles (Lat. *Cingulum*, a girdle). [HERPES.]

Shinwâri, a powerful Afghân nation, whose territory comprises part of the Khaibar Mountains and some of the eastern valleys of the Sufed Koh range; four main divisions, Sangu, Ali Sher, Sipai and Mandu, with about 30 minor groups. The Shinwâri and neighbouring Orakzaes and Afridis are collectively known as Khaibaris.

Ship. [SHIP-BUILDING.]

Ship-broker, an agent who transacts the business for a ship when in port or who buys and sells ships.

Ship-building is an art whose origin is lost in antiquity. Perhaps the Chinese were the earliest practisers of it, and the ships of the Greeks, Romans, and Phœnicians must have been of a high order of merit. The barbarian inroads seem to have destroyed the art generally, though round the Mediterranean it still flourished, and the Norse and Saxon galleys had their good points. A Norse galley, lately discovered in a cairn, was fitted for sails and oars, and was 75 feet long by 16 feet wide. Though an English fleet existed, and fought in early times, England made but slow progress in later times. The order of excellence seems to have been Genoese, Spanish, French, English, and even in the 17th and 18th centuries England copied French models. The *Grâce de Dieu*, built by Henry VIII. in 1514, was of 1,000 tons burden, contained 700 men, and carried 120 guns; but in the 16th century England, in spite of defective types, could hold her own with Spain and Holland. In 1637 appeared the *Sovereign of the Seas*, the first English three-decker; but in the beginning of the 19th century England, and still more America, took the lead. The Baltimore clippers were the first to demonstrate the advantage of sharp over rounded bows, and the square-rigged clippers of the Chinese tea-trade were a further revelation in this direction. The discovery of steam caused a great revolution, but England still clung to faulty theories, which America discarded in favour of practical advantage. The *Sirius* (1838) was the first steamer that went to America, and the first iron ship was the *Great Britain*, constructed in 1843. The last three-decker built for the navy

was the *Duke of Wellington*. The *Great Eastern* gave an impulse to the building of large vessels. As types of two different styles, one may look at the graceful lines of the *City of Rome* and the straight, perpendicular bows of the Cunarders. The invention of the screw was one of the greatest improvements in the construction of ships, since it enabled large vessels to enter harbours which would have been impossible for broad paddle steamers. The wooden ship is become so obsolete that it is hardly worth while to describe the method of building it. The keel, which was so important in a wooden ship, of which it was the backbone, is not of so great importance in an iron ship, which is bolted together, and whose parts mutually support each other. The keel is formed of plates riveted together, and from these arise the ribs, which are held rigid by iron beams. The skin of plates is riveted on to these ribs by thousands of rivets, and sometimes there is an inner skin, which adds to the stability and safety of the vessel. The same object is advanced by the watertight compartments, longitudinal and transverse, which are now almost a constant feature of newly-built ships. When a ship is ready for launching, parallel timbers, called "ways," are arranged under the keel on each side, and upon these are loose timbers, well-greased, and reaching almost to the vessel, wedges of soft wood being driven in between these timbers and the ship's side; the whole apparatus is called a cradle. At the moment of the launch the wedges are knocked away, and all fastenings, except a cable and anchor which drags along the ground and checks the impetus of her enormous weight, are loosed, and she glides with the greased timbers down the ways into the water. There is not so much uniformity of type and design among modern ships of war as in merchant and passenger steamers, since authorities are at perpetual variance as to the merits of different designs.

Ship-Money is the name of a tax imposed at different periods in England for the naval defence of the country, and laid generally upon seaports and maritime counties, certain privileges being granted in return. We meet with it as early as 1007, to provide defence against Norse rovers, and in the time of Elizabeth it was resorted to as a means of providing a fleet against the Spanish Armada; but the question of ship-money came to the front in politics in the reign of Charles I. He in 1634, by exercise of his prerogative, imposed this tax upon London and other seaport towns, giving the authorities leave to raise it by assessment. He met the objections to paying it with obstinacy, and extended it to the whole kingdom. In 1637 John Hampden, by refusing to pay, brought the question to a legal trial in the Court of Exchequer. A majority of eight out of the twelve judges decided in favour of the Crown, and Hampden was condemned; but one of the first measures of the Long Parliament, in 1640, was to declare the exercise of prerogative illegal.

Shipton, MOTHER, the legendary prophetess, has been identified with URSULA SOUTHIEL, who

was born at Knaresborough, in Yorkshire, in 1488; she married Tony Shipton, a builder, and lived upwards of 70 years. In reality, however, most of the tales concerning her are derived from the *Life and Death of Mother Shipton* (1677), by Richard Head. The oldest collection of her prophecies now in existence was published in 1641.

Shiraz, the capital of the province of Fars, Persia, stands in a high valley, 115 miles N.E. of Bushahr. The city itself is cramped and dirty, but has a good bazaar, some handsome mosques, and a few fine private houses. In the neighbourhood are the famous rose-gardens, fruit orchards, and vineyards celebrated by the poets Hafiz and Sa'di, whose tombs lie in their midst. It was probably founded in the 8th century, and has once or twice been the capital of the Empire.

Shirley, JAMES (1596-1666), dramatist, was born in London and educated at Merchant Taylors' School, and St. John's College, Oxford, whence he removed to Catherine Hall, Cambridge. Having resigned his living in consequence of his conversion to the Roman Catholic religion, he became a master at St. Albans grammar school, but, finding the occupation distasteful, he in 1624 established himself in London as a playwright. After the closing of the theatres by the Puritans (1642) he again earned his living by teaching. His plays reappeared on the stage after the Restoration, but he did not produce any new ones. Lamb calls Shirley "the last of a great race"—i.e. the Elizabethan dramatists. His works display the same characteristics as those of his predecessors, but much that in them is the product of original genius must, in his case, be attributed to mere stagecraft.

Shishak, the name of several Egyptian kings of the 22nd dynasty. Shishak I. sheltered Jeroboam after his escape from Palestine during the reign of Solomon, and afterwards made war on Rehoboam and captured Jerusalem. Events connected with this expedition are depicted on the monuments of Karnak.

Shock, the group of symptoms produced by some profound impression affecting the nervous centres, either directly, as in great mental disturbance, or indirectly, as in the case of severe injury affecting the peripheral nerves. The symptoms of shock are partial or complete loss of consciousness, muscular weakness, cold, clammy skin, feeble, rapid pulse, quickened respiration, lowered temperature, and loss of control over the sphincter muscles. In the case of head injuries the variety of shock sometimes spoken of as *concussion of the brain* occurs. [CONCUSSION.] When recovery from the condition of shock sets in, a period of reaction supervenes, with raised temperature. The treatment of shock consists in the maintenance of absolute rest in the horizontal position, in applying heat by means of warm flannels, hot-water bottles, and the like, and, in certain cases, in administering stimulants.

Shoddy originally denoted the waste from the manufacture of wool, and this was hardly utilised;

but since then this waste, together with cuttings of flannel, wool, etc., is redevilled, spun, and woven into fresh cloth, being called *new shoddy*, to distinguish it from similar cloths manufactured from old clothes, this latter being called *old shoddy*. In the same way we have *new mungo*, formed from clippings of milled cloth, and *old mungo*, formed from old cloth. Shoddy is not so lasting as the original material, but is much cheaper.

Shoe-Bill Stork (*Baleniceps rex*), a large wading bird from the Upper Nile. The name refers to the strangely-shaped bill.

Shore, JANE, the mistress of Edward IV., was the wife of William Shore, who is said to have been a goldsmith in Lombard Street. In consequence of her *liaison* with the king she was abandoned by her husband. After Edward's death she attached herself to Lord Hastings, and was accused of conspiring with him to injure Richard III. by unholy spells; but, this charge proving groundless, she was forced to do penance for her immoral life at St. Paul's. She afterwards became the mistress of the Marquis of Dorset. She was still living in 1513, when More wrote his *Life of Richard III.*, in which there is a graphic description of her beauty. The story of her miserable death in Shoreditch is unfounded.

Shorthand is the name given to the abbreviated systems of writing which enable a writer to express his ideas in a much shorter time. The modern practice of reporting speeches in full, and the great increase in public speaking, are the immediate cause of the study of shorthand, though the employment of a system of shorthand was known to the ancients (a system being ascribed to Tiro, a freedman of Cicero), and in England in the 16th century. Most people who write much employ more or fewer abbreviations, but for professional purposes a general system is required, since others than the writer have to read what he has written. The system most in use is that invented in 1837 by Isaac Pitman. The whole system is too complicated and too long for any attempt here at detailed description, and books on it are so easy to come by that it is needless. Suffice it to say that sounds are classified as formed by the lips, teeth, palate, throat, and nose; that lines and curves thick and thin are used to form consonants; that the vowels are rendered by dots and dashes; that phonetics are utilised; that there are many combinations; and that many words of constant occurrence are rendered by grammalogues. Other systems are Script, which many prefer to the Pitman system, and Oxford shorthand.

Short Sight. [EYE, MYOPIA.]

Shoshonean ("Snake") Indians, a widespread North American people, whose domain extends from Oregon, California, and Idaho in a southeasterly direction through Nevada, Utah, Colorado, parts of New Mexico and Texas, nearly to the Gulf of Mexico. Formerly parts of Montana, Wyoming, Indian Territory, and even Kansas and Arkansas were also occupied by this great family, all of

whose members speak dialects of a common stock language. Chief branches : Shoshoni and Bannock (1,720), chiefly in Fort Hall Reserve, Idaho ; Cheme-huevi, Comanche, and Tobikhar (4,000), in various Colorado, Arizona, Indian Territory, and Californian Agencies ; Uta (2,840), in Colorado and Utah Agencies ; Pai Uta, Paviotso, Tusayan (Moki) 7,300, still at large in Oregon, California, Nevada, and New Mexico ; total population (1890) about 16,000.

Shot, in artillery, denotes any solid projectile discharged from a cannon. All shot, however, is not absolutely solid, since the so-called Palliser shot has a cavity within it containing powder or other explosive substance, and this is exploded by force of impact, no fuse being employed. The introduction of longitudinal shot has almost rendered obsolete such combinations as bar-shot, chain-shot, canister, and grape. In the first of these two shots were joined by an iron bar, in the second by a chain ; canister was a hollow ball or canister containing a number of bullets, which were scattered by the discharge ; and grape consisted of a number of bullets connected like grapes on a stem. Shot for sporting-guns varies in size from buck-shot, the size of a pea, to the smallest dust-shot. The uniformity of the shot is obtained by dropping the molten lead from a height into a tub of water, arsenic being sometimes added to give a greater degree of hardness. The shot is sorted by being rolled over sloping sieves which have various-sized round orifices which just fit the different types required and reject imperfect shots. Having been thus sorted, they are polished by being placed in rotary barrels in which is placed a certain quantity of black lead.

Shoulder Joint, the ball and socket joint which is formed by the articulation of the rounded head of the humerus with the glenoid cavity of the scapula. For diseases of the shoulder joint, *see* JOINT. The shoulder is a joint which is not infrequently dislocated.

Shovel, SIR CLOUDESLEY (*c.* 1650–1707), an English admiral of humble parentage, probably born at Clay in Norfolk. He ran away to sea, and, speedily rising through the humbler ranks, served as lieutenant under Sir John Narborough against Tripoli (1674). He was present at the actions in Bantry Bay (1689) and off Beachy Head (1690), and took a very prominent part in the battle of La Hogue (1692). He subsequently served under Rooke in the Mediterranean, and in 1705 became commander-in-chief of the British navy, co-operating in that capacity with Peterborough (1705–7). During his voyage back to England his ship was wrecked on the Scilly Isles, and all on board were drowned.

Shoveller, any bird of the genus *Spatula*, of the Duck family, with five species from all temperate regions. The hind-toe is free, and the bill greatly expanded at the tip. The Common Shoveller (*S. clypeata*) visits Britain in the winter. The plumage of the male is boldly marked with white ; that of his mate is uniform liver-brown.

Shrew, any animal of the Insectivorous family Soricidae, with several genera, very widely distributed, but absent from Australia. In appearance they resemble rats and mice, from which they may be distinguished by the presence of canine-like teeth and the character of the incisors, and by their long pointed muzzle. In habit they are usually terrestrial, though some are aquatic. Scent-glands are present. The type-genus (*Sorex*) has two British species. The Common Shrew (*S. vulgaris*) is about the size of a mouse, with brownish fur above and greyish below. It ranges eastwards through Europe and



SHREW. (*Sorex vulgaris*.)

Asia to North America. It is found in dry places in the open country and in gardens, and feeds on snails, slugs, worms, and insects. These creatures are very pugnacious, and when two meet a fight generally ensues, and the weaker is killed and eaten. In late summer and autumn, probably owing to scanty food-supply, numbers of shrews are found dead, but showing no signs of injury. Moles, weasels, owls, and cats will kill shrews, though puss will rarely eat them. The Lesser Shrew (*S. pygmaeus*) is smaller, and less common in Britain than the first species. It extends to Ireland, from which country *S. vulgaris* is absent, as is the Water-Shrew (*Crossopus fodiens*), much larger than the Common Shrew, and having the feet fringed with stiff hairs. It burrows in the banks of rivers and lakes, and feeds on small crustaceans, insects and their larvæ, and fish-fry. From Britain it ranges eastward to the Altai Mountains. Aberrant forms of the family are the mole-like tailless shrews from Tibet and Assam, and Tibetan Water-Shrew, with webbed feet and adhesive pads on their under-surface. [MUSK-SHREWS.]

Shrew-Moles, a popular name for some moles from North America which have the muzzle elongated and the hind-feet webbed. The Shrew-Mole (*Scalops aquaticus*) and the Prairie-Mole (*S. argentatus*) are widely distributed in the United States. The Texan Shrew-Mole (*S. latimanus*) is confined to Texas and Mexico. The other forms are sometimes placed in a separate genus on account of some differences in the teeth.

Shrewsbury, the capital of Shropshire, stands on a bend of the Severn, 30 miles S. of Chester, and

has stations on the Great Western and London and North-Western Railways. Under the name Pengwerne, it was founded in the 5th century as a border fortress, held high rank among Saxon cities, and after the Conquest played an important part as the seat of several Parliaments, the scene of a great battle in 1403, and the headquarters of Charles I. in 1642. The Old grammar school, founded by Edward VI., now serves as a museum, handsome new buildings having been erected at Kingsland in 1882. The market-house dates from 1595, and the streets contain many interesting examples of domestic architecture. Three fine bridges span the river. The local industries include the making of thread, linen, and canvas, and iron-founding. Salmon are fairly abundant in the river. Shrewsbury, since 1885, returns one member to Parliament.

Shrike, any bird of the Passerine genus *Lanius*, with fifty species, universally distributed except in South America. The bill is short and stout, and the upper mandible bears a strong tooth. They are chiefly insect-eating birds, but sometimes prey on mice, young frogs and lizards, and small birds, and, from their habit of impaling their prey on thorns, are often called Butcher-Birds. The Red-backed Shrike (*L. collurio*) is a well-known summer visitor, though somewhat local; it migrates when the brood is reared. The Lesser Grey Shrike (*L. minor*) is an occasional, and the Great Grey Shrike (*L. excubitor*) a regular winter visitor. [WOODCHAT.]

Shropshire, or SALOP, a county of England on the Welsh border, is bounded N. by Denbighshire, Flintshire, and Cheshire, W. by Radnorshire, Montgomeryshire, and Denbighshire, S. by Worcestershire and Herefordshire, and E. by Staffordshire. It has an area of 1,314 square miles, being divided almost in two by the Severn running north-west to south-east. The lower portion is rugged and bleak, the Cleve Hills, the Stiperstone rising to nearly 2,000 feet. This district, however, pastures large flocks of a well-known breed of sheep, and is very rich in lead, coal, iron, salt, and other minerals. The level plains to the north are well suited to arable and dairy farms. Hops are grown in the south. Glass, earthenware, carpets, gloves, and hardware are the chief manufactures. Besides the capital, Shrewsbury, the most important towns are Ludlow, Bridgenorth, Much Wenlock, Wem, Shifnal, and Bishop's Castle. The county returns four members to Parliament.

Shrove-Tide is the name given in England to the time immediately preceding Lent, and is generally applied only to the Tuesday before Ash Wednesday. The name is derived from the old custom of going to confession, or being shriven, on that day, which was regarded as a fast. Hence the custom of eating pancakes on Shrove Tuesday; but in modern times carnival festivities have ousted the fast. In Germany the day is called Fast Nacht, and in France Mardi Gras.

Siah-Posh Kafirs ("Black-clad Infidels"), the pagan inhabitants of Kafiristan on the southern slope of the Hindu-Kush, so called by their

Mohammedan Afghan neighbours. There appears to be no collective national name, though *Kamoji*, that of the most important group, is sometimes applied to the whole people; nor are there any true tribal divisions, or at least such as do exist are of topographical origin. Such are the Vaigal, Rangal, and Bashgal, answering to the three chief river valleys, with total estimated population 600,000, under eighteen chiefs. Speech, a Galcha language intermediate between Iranian and Sanskrit, spoken in ten different varieties. Type, distinctly Caucasian, with regular features, blue and dark eyes, hair of all shades between light brown and black, broad open forehead, tall stature, shapely figures; but General Abbot distinguishes between this noble type, that of the aristocracy (who claim descent from the Macedonian conquerors), and a very dark type, that of the non-Aryan aborigines. (W. W. McNair, *A Visit to Kafiristan*, *Proc. Royal Geographical Society*, December, 1883.)

Sialagogue, a substance which promotes salivary secretion.

Siam, a kingdom occupying the central part of the Indo-Chinese, and extending into the Malay peninsula, being bounded N. by the Shan States, W. by Burma, E. and N.E. by Anam and Tonkin (under French protection), S. by Cambodia (also controlled by France), and the Gulf of Siam. Johore, or Pahang, must

be regarded as the limit towards Malacca. However, the "delimitation" of Siam is still being actively pursued, and the French now claim all territory east of the Mekong as far as 104° E. long., whilst their pretensions are gradually extending northwards. To the south they have already encroached as far as Chantabun, and Siam is practically confined to the valley

of the Menam. This is the most fertile part of the kingdom, the alluvial soil, watered by yearly floods, yielding an inexhaustible supply of rice, which is brought down the stream to Bangkok for shipment. To the west of this valley the Me-wang and Me-ping bring their tributary waters through a more rugged country embracing several rich plains, whilst close to the Burmese frontier the Toongyeen, flowing north, waters teak-forests and cinnamon-groves. To the east of the Menam there is much sterile and sandy land (the Korat plateau), with swampy and unhealthy river-flats at intervals. This plateau is bounded S. by a range stretching into Cambodia, and famous for precious stones, whilst the mountains to the north contain many



MAP OF SIAM.

valuable minerals, the natives only extracting a little iron. Tin is found in considerable abundance in the Malay peninsula and other parts. Gold is obtained both by mining and washing; lead, silver, iron, antimony, and copper are abundant, but little worked. There is some trade by caravans through the Shan States with Yunnan and China. The government is a monarchy, but there exists an official known as a "second king," whose vague functions appear to be on the wane. Buddhism is almost the universal religion. Besides Bangkok the capital, Chantabun, Meklong, Paklat, and Paknam are important coast towns, Luang-Prabang and Kiang-Kong on the upper Mekong, Phitsalok and Ayuthia on the Menam, Raheng and Lapoon on the Me-ping being the chief places inland. Siam was first visited by Europeans in 1511, but it was not until 1856 that the Siamese relaxed their exclusive policy, and that step, though unavoidable, they will probably have good cause to regret.

Ethnology. The dominant inhabitants of Siam call themselves *T'hai* ("Free," "Noble"), and are a branch of the widespread *Shan* race, *Siam* being merely a corrupt form of *Shan* through the Portuguese *Sião*. The Siamese proper, most civilised of all the Shan peoples, are concentrated chiefly in the Menam basin and in the Malay peninsula as far south as about 8° N. lat., where they are conterminous with the Malay race. They retain in a somewhat modified form all the physical traits of the Mongoloid Shans: broad features, high cheek-bones, small nose, slant eyes, black lank hair, beardless face, small stature, olive complexion. Their culture has been developed under Hindu influences, their monosyllabic Indo-Chinese language being largely charged with Sanskrit elements and written in a syllabic alphabet derived through the Pali from Devanagari (q.v.); hence a corrupt form of Buddhism is the prevailing religion. Of the 8,000,000 inhabitants of Muang-T'hai ("Land of the Free"), as Siam is officially called, not more than 2,500,000 are Siamese proper, the rest being Laos (Eastern Shans), about 2,000,000; Chinese, 1,500,000; Malays, 1,000,000; Cambojans, 300,000; Burmese, Talaings, Karens, and wild tribes, 700,000; but since the cessions to France in 1893 these figures have been considerably reduced, and the present population is estimated at little over 5,000,000.

Siamese Twins, a *lusus naturæ*, born in Siam, of Chinese parents, in 1811. They were males, and were called Eng and Chang respectively, and were for many years exhibited in different parts of the world. Their bodies were united by a band of flesh and cartilage containing certain inter-communicating vessels. The brothers were 5 feet 2 inches tall, were well made and muscular, and could lift a weight of 20 stone. They were active, swam, walked and ran, and played chess and draughts. In many respects they were one, and their emotions, impressions, and wants were in common, so that they had little need to speak to each other. On the other hand, towards the end of his life Chang took to drinking, and could get drunk without affecting Eng, and the latter was

not aware of Chang's death till he woke, he himself dying shortly afterwards, it is said, of mental shock caused by Chang's death. An elaborate post-mortem examination was made. Both men were married and had children.

Sibbes, RICHARD (1577-1635), Puritan divine, was born in Suffolk, and educated at Cambridge, where he became master of Catherine Hall in 1626. He wrote *The Bruised Reed* (which led to the conversion of Richard Baxter), *The Soul's Conflict*, and other devotional works.

Siberia, the territory belonging to Russia in Asia. [KAMCHATKA, ASIA, TOBOLSK, SAGHALIEN, URALS, YAKUTSK, RUSSIA.]

Sibyl, a name given to certain prophetic virgins—ten or more in number—of ancient times, the most noted of whom was She of Cumæ. This sibyl it is who is said to have offered the nine sibylline books, prophetic of the fortunes of Rome, to King Tarquin at a certain price. He demurred, whereupon she burnt three, and offered the remaining six at the same price. Again he hesitated, and again she burnt three, finally making over to him the three left at the original price. Priests were appointed to take charge of them and study their interpretation. These were afterwards increased to fifteen. In B.C. 83 the books with the temple that contained them were burnt. Researches were made in different directions, the result being that about 1,000 sibylline utterances were discovered. They were revised from time to time to eliminate forgeries, and were more than once again destroyed by fire; and even as late as 270 A.D. it was proposed that they should be consulted. A supposed collection of those remaining was published at Amsterdam in 1689.

Sibylline Books. [SIBYL.]

Sicilian Vespers is the name given to a massacre of the French in Sicily in 1282. Charles of Anjou, who was king of Naples and Sicily, governed tyrannically, and a certain Giovanni di Procida went to Peter of Aragon, who had married Constantia, daughter of Manfred, and invited that king to attack Charles, promising aid both in men and money. Peter consented, and fitted out an expedition, ostensibly against the Moors of Africa. Meantime, on March 30, 1282, Palermo massacred all the French in the city, the vesper bell being the signal. This example was followed by Messina. Charles thereupon laid siege to Messina, but the approach of Peter compelled him to raise the siege and flee. Constantia's rights were acknowledged, and the crown was settled upon her second son.

Sicily (classic *Trinaeria*), an island of triangular shape in the Mediterranean at the extremity of the Italian peninsula, from which it is separated by the Strait of Messina, only 2½ miles at its narrowest. From east to west the island measures about 185 miles, the distance between extreme north and south being 120 miles and the total area 11,290 square miles. The interior is very mountainous, for the Peloric and Nebrodian ranges, extensions of the Apennines, rise to the height of

several thousand feet, and there are detached masses such as Etna, the still active volcano (10,874 feet), in the south-east. Fine plains, however, spread here and there along the coast, possessing the deepest and richest alluvial soil, and each with a good harbour—*e.g.* Palermo and Castellamare in the north, Catania, Syracuse, Lentini, and Terra-Nova in the south and east, Trapani and Marsala to the west. In these districts even tropical fruits will grow, and they served as the granary of ancient Rome. Wine is abundant. The uplands feed merino sheep, but the old pastoral habits have decayed. There are valuable forests on the flanks of the mountains, and the great mineral wealth remains almost unexplored, though sulphur, alum, nitre, rock-salt, and a few marbles are exported with the olive-oil, white wine, oranges, lemons, raw silk, barilla, and fish that form the staples of trade. Industries are paralysed by many years of past misgovernment, of brigandage, religious mendicancy, priestcraft, and by the recurrence of earthquakes. Recently serious troubles have arisen through the system of local administration, which presses severely on the agricultural classes, and from the pernicious system of land tenure, involving much sub-letting. Sicily first appears in history as the seat of early Greek colonies, and it played an important part in the struggle between Athens and Sparta, and also in the history of Rome until reduced to a province at the end of the second Punic War. After the fall of the Empire it fell for two centuries into the hands of the Saracens, from whom it was wrested by the Norman Crusaders in the 11th century, soon afterwards becoming incorporated with Naples in the kingdom of the Two Sicilies. Several times was this union dis-severed, and many changes of dynasty occurred, but the Garibaldian movement of 1860 enabled the Sicilians to throw off the Bourbon yoke and join United Italy. The island is now divided into seven provinces—viz. Palermo, Messina, Catania, Siracusa, Caltanissetta, Girgenti, and Trapani, the Governor having his residence at Palermo.

Siddons, SARAH (1755–1831), the greatest of English tragic actresses, was born at Brecon. Her father, Roger Kemble, was the respectable manager of an itinerant theatrical company. She appeared on the stage at a very early age, and in her nineteenth year became the wife of an actor named Siddons, who belonged to her father's company. In 1775 she played Portia to Garrick's Shylock at Drury Lane without attracting much notice, but her subsequent successes at Birmingham, York, Bath, and elsewhere were so extraordinary that in 1782 she appeared a second time at Drury Lane, her rôle being now Isabella in *The Fatal Marriage*. Her success was immediate and complete, and from that time forward she was recognised as the leading actress of the day. In 1803 she joined her brother, John Philip Kemble, at Covent Garden, and played at that theatre till her retirement from the stage in 1812. Of the numerous tragic parts in which she stood unrivalled, Lady Macbeth is probably the one most closely associated with her name.

Sidereal Clock is a specially-regulated clock for measuring sidereal time. Accuracy is the great essential of observatory clocks, and so carefully are they now made that their variation seldom exceeds a second per day. Jewelling the holes has greatly diminished the errors due to friction, but careful compensation of the pendulum [PENDULUM], so that its length is the same whatever be the temperature, has been the chief cause of the accuracy now attainable. Time measured in an observatory begins, not at noon as in an ordinary clock, but at the moment when the vernal point of intersection of ecliptic and equator—the first point of Aries—crosses the meridian, and from this point the hours go on till *24 o'clock*. The time of the clock is constantly checked by means of the transits of certain stars. A number of such reference stars have had their right ascensions very accurately determined. Every day some of these are observed, and give the error of the clock. To find the right ascension of any celestial object, the time of its transit is noted, and its angular right ascension is got by converting the time into angles at the rate of 15° for each hour.

Sidmouth, HENRY ADDINGTON, 1ST VISCOUNT (1757–1844), was the son of Dr. Anthony Addington, Lord Chatham's family physician. He entered Parliament as a supporter of Pitt in 1781, and held the office of Speaker from 1789 to 1801, when he succeeded Pitt as Prime Minister. The single event of importance in his feeble administration (1801–4) was the negotiation of the Peace of Amiens (1802). His repressive measures as Home Secretary under Lord Liverpool (1812–22) showed little political sagacity, but his Tory convictions appear to have been genuine.

Sidney, ALGERNON (? 1622–83), son of Robert, 2nd Earl of Leicester, was probably born at Penshurst, near Tunbridge. After taking part in the suppression of the Irish rebellion (1642), he entered the Parliamentary army, and was badly wounded at Marston Moor. In 1646 he accompanied his brother, Lord Lisle, to Ireland as Lieutenant-General of the Horse, and in 1647 he was made Governor of Dover. He took no part in the trial and condemnation of Charles I., but he subsequently pronounced his execution a patriotic measure. After the dissolution of the Long Parliament (1653), he withdrew to Penshurst, and there wrote his *Discourses on Government*, a work advocating republican principles. He was engaged in diplomatic business at Stockholm when the Restoration occurred, and continued to reside on the Continent till 1677, when he obtained permission to return. His negotiations with the French ambassador, Barillon, from whom he is said to have received money in 1680, have given rise to much conjecture. After the death of Shaftesbury (1682) he became one of the most active leaders of the Whig party. There is no evidence that he was implicated in the Rye House Plot; nevertheless, he was brought to trial, condemned to death on the testimony of a single perjured witness, and beheaded on Tower Hill. His attainder was reversed in 1689.

Sidney, SIR PHILIP (1554–86), an English statesman and poet, whose noble life and chivalrous

death have justly made him the ideal of knightly heroism. He was the son of Sir Henry Sidney, an able and upright Irish Viceroy, and Mary Dudley, daughter of John, Duke of Northumberland, and sister of Elizabeth's favourite, the Earl of Leicester. He was born at his father's seat of Penshurst in Kent, and received his education at Shrewsbury school and Christ Church, Oxford. In 1572 he set out on the grand tour, and was at Paris on the night of the massacre of St. Bartholomew. At Frankfort he made the acquaintance of his lifelong friend, the scholar Hubert Languet. After visiting Italy, he returned to England in 1575, and, aided by the patronage of his uncle Leicester, rapidly made his way at Court. In 1577 he went as ambassador to the Emperor Rudolph for the purpose of effecting a permanent union of the Protestant states—an impossible project, for the failure of which Sidney is not to be blamed. Having incurred Elizabeth's anger by a bold address, pointing out the evils which would result from a marriage with the Duke of Anjou, he withdrew from Court in 1580, and lived for a time with his sister, the Countess of Pembroke, at Wilton. In 1585 he was about to set sail with Drake on an expedition against the Spaniards in America, when he received a message from the Queen forbidding him to leave England. He was, however, allowed to accompany Leicester, who was sent to the Netherlands to aid the Dutch in their struggle with the Spaniards, and there, through a noble act of courage and self-sacrifice, he lost his life on the battlefield of Zutphen (September 22, 1586). As a poet Sidney appears at his best in *Astrophel and Stella*, a series of beautiful sonnets commemorating his hopeless passion for Penelope Devereux, sister of the Earl of Essex and wife of Lord Rich. His pastoral romance, *The Countess of Pembroke's Arcadia*, occupies an important position in the development of English prose, and was very popular in its own day, but it is too prolix and artificial to please the present age. Another prose work, *The Defence of Poesie*, still keeps its place as a classic.

Sidon (*modern SAIDA*), an ancient Phœnician city which was situated in a plain on the coast of the Mediterranean, about 20 miles N. of Tyre. It was probably the earliest Phœnician settlement, and attained great commercial prosperity before the Jewish immigration, being subsequently eclipsed by its off-shoot Tyre. Cyrus and Alexander successively conquered it, and the Egyptians, Romans, and Turks became its masters. The existing village lies W. of the ruins of the city, and belongs to the Pashalik of Acre.

Sidonius Apollinaris, a Latin writer of the 5th century, born at Lyons. He married the daughter of the Emperor Avitus (456), and in 472 became Bishop of Clermont in Anvergne. His works, which possess considerable historical value, include nine books of letters and panegyrics in verse on three emperors.

Siege ("a sitting down before") is the name given to a particular mode of attacking a fortified town which cannot be taken by surprise or by direct

assault. The siege differs from a blockade in that the latter consists in simply preventing ingress to or egress from the city; though sometimes the two are combined, as in the case of the siege of Antwerp in the 16th century. The first thing necessary in establishing a siege is to overpower any outlying forts that might harass the attacking party. Batteries are then established within easy cannon-range, and the attack is opened. Meantime a gradual advance is made upon the stronghold by means of trenches, which are protected at intervals by parallels, and which are carried on by zig-zags, so as to avoid being swept by the enemy's fire. In the case of a moat, mining is employed if possible. Provision is made in the trenches and parallels for accommodating a sufficient number of troops to repel any sortie attempted by the besieged garrison. When a breach is made in the walls by mining or direct battery, the assault is delivered. There were memorable sieges in the Peninsular War; and in later times those of Sebastopol, in the Crimean War, and of Paris, in the Franco-German War, were of much importance.

Siemens, SIR WILLIAM (KARL WILHELM) (1823-83), metallurgist and electrician, was born at Leuthe, in Hanover, and received his education at the Polytechnic school of Magdeburg and the university of Göttingen. In 1843 he came to England in order to patent a process for electro-gilding, invented by his brother, WERNER VON SIEMENS (b. 1816), and himself. A second journey to England in 1844, in which he brought with him his "chronometric" or differential governor, was followed by his permanent settlement in this country, Wilhelm conducting the affairs of "Siemens Brothers" in England, whilst Werner, also an able electrician, for the most part resided in Prussia. Wilhelm's genius received ample recognition, and in 1882 he was President of the British Association. Among his more important inventions were the regenerative furnace, the selenium eye, and various electric railways. He also devised the steamer *Faraday* for laying the Direct United States Cable in 1874.

Sienna, or SIENA, a province of Italy, and its capital. The former has an area of about 1,500 square miles in the centre of Tuscany, the northern portion being mountainous, but yielding fine marbles, whilst the plains and valleys are fertile. The city, picturesquely built on three steep hills, was in the Middle Ages a strong and wealthy place, the centre of a republic which rivalled Florence and Pisa. Its cathedral (11th to 13th century) is the noblest existing specimen of Italian Gothic, and contains many magnificent works of art. The university founded in the 14th century still flourishes, especially as a medical school.

Sierra Leone, a British settlement and Crown Colony in Western Africa, occupying a peninsula about 25 miles by 12 miles, and several islands, on the south coast of Senegambia, near the mouth of the Rokello or Sierra Leone river. It was established in 1787, and colonised by liberated negro slaves. The soil is exceedingly rich, but most of it

is covered by rank forest growth, and the climate is very unhealthy. Freetown is the residence of the Governor and the administrative centre, as well as the seat of an Anglican bishopric.

Sierra Nevada ("Snowy Range"), (1) the name given to the most southernly and elevated of the parallel systems that cross Spain from east to west. It traverses the whole of Granada from Alhama to Baza, a distance of over 100 miles, and contains the peaks of Mulhacen (11,678), and Veleta (11,378), the snow-line being drawn at about 9,500 feet. In geological formation the range resembles the Pyrenees, and is rich in iron, copper, silver-lead, zinc, and antimony. (2) The great chain of North America, which runs parallel to the Rocky Mountains between California and Utah also bears this name in part of its course. The Sierra Nevada forms the west boundary of the state of Nevada, and extends from lat. 37° to 42° N., being the watershed of the Sacramento, the San Joaquin, and other Californian rivers. The best known peak is Mount Shasta (14,000 feet). In formation the range is volcanic, and it possesses great mineral resources, silver being especially abundant.

Sieyès, EMMANUEL JOSEPH (1748-1836), commonly known as the Abbé Sieyès, the most intellectual of the politicians who took part in the French Revolution, was the son of the director of the post-office at Fréjus, where he was born. After receiving his early education from the Jesuits of his native town, he studied philosophy and theology at St. Sulpice, and was appointed vicar-general by the Bishop of Chartres. In response to Necker's invitation to French writers to make known their views concerning the manner of assembling the States-General, he published several political pamphlets, including the famous *Qu'est-ce que le Tiers-État?* (*What is the Third Estate?*), which undoubtedly hastened on the Revolution. When the States-General met in 1789, he appeared as deputy for the city of Paris. It was he who suggested that the three estates should form a single assembly, and proposed the name "National Assembly," which was adopted by the unified body. He was but a poor speaker, but he maintained his position as an abstract politician and a framer of constitutions, winning new laurels by his published speech opposing the royal veto. In the Legislative Assembly he sat in the Centre, but he had not the courage to defend the Girondists, and sank into comparative obscurity, only coming forward at the installation of the Goddess of Reason to renounce his faith in the Christian religion. In 1795 he was one of a commission appointed to frame a new constitution, but his proposals were rejected. In 1798 he was sent as ambassador to Berlin, and began to intrigue with Napoleon. The *coup d'état* of 18 Brumaire (November 9, 1799) was followed by the establishment of the Third Consulate, composed of Napoleon, Sieyès, and Ducos, but Sieyès was outwitted by his great colleague, and was glad to retire to an estate at Cosne with the title of count and a handsome pension. After the second return of the Bourbons he fled to Belgium, but in 1830 he returned to Paris, where he died.

Sigillaria, a genus of fossil club-mosses, belonging probably to the order Selaginellaceæ, which formed one of the chief types of the vegetation of the Coal-measures. They had large and lofty stems, either unbranched or dichotomous, covered with the scars of fallen leaves in vertical rows. The leaves were narrow, linear and sedge-like, reaching eighteen inches in length; but generally only the cushion of attachment is preserved. The roots, known as *Stigmara*, are found in the fire-clay below coal-seams, and in the Devonian. They reach twenty or thirty feet in length, and are cylindric and dichotomous. Their outer surface is pitted with the scars of the rootlets, and they have a medulla and a vascular cylinder of scalariform tracheids, growth being apical. The cone of fructification, known as *Sigillariostrobus*, is rare. It resembles *Lepidostrobus*, that of *Lepidodendron*, and was probably heterosporous.

Sigismund, the younger son of Charles IV., Emperor, was born in 1366, and succeeded his father as Margrave of Brandenburg in 1378. Having married Maria, daughter of Ludwig of Hungary, he was elected to fill that throne. In 1410, on the death of Ruprecht, Palatine of the Rhine, he was put forward by a strong party as candidate for the imperial dignity, and after some disputes received the unanimous vote of the Diet, being crowned in 1414. Under his auspices the Council of Constance was held, and his reign was one continual struggle with the Hussites, whose leader he treacherously burned in 1415. His later years were passed in wars against the Turks, from whom he took Belgrade. With him the Luxemburg dynasty ended, as at his death in 1437 he left only a daughter. By the sale of Brandenburg to the burgrave of Nuremberg he laid the foundation of the Prussian kingdom.

Signalling is the means of conveying from a distance information to the eye or ear of intelligence that cannot otherwise be made known. Among the contrivances made use of are flags, boards, lights, guns, bells, steam-whistles, etc. In the navy signalling is especially required, and has of late been largely adopted in military operations. Signalling at sea has been much simplified by the introduction, by Marryat and later experimentalists, of a system of codification, whereby at present a limited set of signals is made to do duty for some fourteen thousand words and phrases. Naval signals generally employ a few simple flags and a few colours, the later tendency being to employ only black and white to avoid possible confusion of colours. Collapsible cones also are largely employed, as are, too, the electric light by night and the heliograph by day. Signalling by hand-flag has been much used and developed of late. Most of the signalling by hand-flag, or by light, carried on by the use of the Morse alphabet, long and short waves of the flag, or long and short flashes of light, taking the place of dots and dashes. As this is employed often in telegraphy also, a knowledge of the alphabet is useful to everyone. This alphabet is as follows:—

MORSE ALPHABET.

.	=	E	—	=	B
.	=	I	—	=	K
.	=	S	—	=	Q
.	=	H	—	=	C
.	=	T	—	=	X
—	=	M	—	=	Y
—	=	O	—	=	Z
.	=	A	. . . . .	=	U
.	=	W	. . . . .	=	V
.	=	J	. . . . .	=	F
—	=	N	. . . . .	=	L
—	=	G	. . . . .	=	P
—	=	D	. . . . .	=	R

FIGURES.

.	=	1	—	=	6
.	=	2	—	=	7
.	=	3	—	=	8
.	=	4	—	=	9
.	=	5	—	=	0

Railway signalling is accomplished chiefly by the use of semaphores, coloured lights, and detonators, and occasionally by means of flags.

Signatures, a natural marking upon a plant, formerly supposed to be indicative of some special use.

Signorelli, LUCA, or LUCA DA CORTONA, was born in 1441, and soon becoming the chief of the Florentine school of painting, was invited to Rome in 1484, where he painted two of the frescoes in the Sistine Chapel. His best work, however, is to be seen in the cathedral of Orvieto, *The Last Judgment* having supplied Michelangelo with suggestions for his own great picture. Several altar-pieces of his exist at Cortona, and other pictures in oils are preserved in Continental galleries, but genuine specimens are rare. He died about 1525.

Sigourney, LYDIA HOWARD, was born in the United States in 1791, her maiden name being HUNTLEY. Her first literary venture was made in 1815, and consisted of a volume entitled *Moral Pieces in Prose and Verse*, which met with considerable success. Her most popular books are *Connecticut Forty Years Since*, *Letters to Young Ladies*, *Pleasant Memories of Foreign Lands*, and *Pocahontas and Other Poems*. Her letters were published after her death, which occurred in 1865.

Sihon, King of the Amorites, was evidently a warrior of great renown. He and his army were utterly destroyed by the Israelites.

Sikhs, *i.e.* "Disciples," members of a peculiar sect, which was founded in the Punjâb by Nanak in the 15th century, and which may be described as a monotheistic reformation of Brahminism developed under Moslem influences. Its tenets are embodied in the Granth or Sacred Books, which are accepted both by the Khalsa or Old Sikhs and the Singhs ("Lions"), as the reformed Sikhs call themselves. The term has acquired a certain ethnical significance from the fact that all the Sikhs belong to the Jât race, and are distinguished by their fine development, courage, and loyalty.

Sikkim, a native state on the southern flank of the Himalayas, which separate it from Tibet, Bootan bounding it to the E. and Nepaul to the W. It has an area of about 4,400 square miles, most of the surface being mountainous, but the

lower terraces are suited to the cultivation of tea. In 1892 the rajah was made a feudatory of Great Britain, and now lives in retirement. The important settlement of Darjeeling is just S. of Sikkim, and the resident there administers the state.

Silenus, in classical mythology, was a demi-god, the son of Hermes or Pan by some nymph. The youthful Bacchus was committed to his charge. He accompanied him to India, and is generally depicted as a fat and drunken old man riding on an ass, and surrounded by a riotous crew of fauns and bacchantes. He received most veneration in Elis and Arcadia.

Silesia (German *Schlesien*), a district of Germany situated south of Brandenburg and north of Moravia and Bohemia, and having an area of some 18,000 square miles. From the 10th to the 12th century this tract was under Polish government, and from the 12th to the 14th century it was divided into two duchies, Upper and Lower Silesia. After the 14th century it became broken up into a number of petty states: Schweichnitz, Glogav, Oels, Jägerndorf, etc., over most of which Bohemia exercised suzerainty. In 1537 the Duke of Liegnitz left his dominions to Brandenburg, and thus gave rise to the struggle between Austria and Prussia for the possession of this territory, which was only brought to an end with the Seven Years' War. Prussia then got the greater share (15,666 square miles), and Austria about 2,000 square miles. The capital of the Prussian province, which embraces some of the richest and of the most picturesque land in Germany, is Breslau, Troppau being the chief town of Austrian Silesia.

Silhouette, a profile portrait which is filled in in black upon a white ground, derives its name from a M. de Silhouette, who was French Finance Minister in 1759, according to some, because he delighted in making these portraits. Silhouettes can be cut from black paper and pasted on a white ground, or can be traced from shadows on the wall. They may be enlarged or reduced by an instrument called the pantograph.

Silica consists of the oxide of silicon represented by the formula SiO_2 . It is very plentiful upon the crust of the earth, both in a free state and combined with other oxides, and is by far the most abundant oxide. It also occurs in many grasses and bamboos, and also in birds' feathers. In minerals it occurs free:—crystalline, as *quartz* (q.v.), and *tridymite*, and in a non-crystalline form as the *opal*. Flint is also a form of silica, while the *agate* and *chaledony* are mixtures of the amorphous and crystalline varieties. Sand and sandstone, quartzite, and some other rocks, consist chiefly of silica. In combinations it acts the part of an acid, uniting with other oxides to form *silicates*, and, according to the quantity of silica present, rocks are known as acid, intermediate, or basic. It may be prepared artificially as a white powder, insoluble in acids, except hydrofluoric, possessing a specific gravity of 2.2. It is very infusible, but may be melted in the oxyhydrogen

flame. Many hot springs and geysers contain silica, as it is soluble in alkaline hot solutions. The compound is precipitated from the water as it cools and evaporates, and by this means great deposits of silica may be found, as in the "sinter" terraces in Yellowstone Park and other localities.

Silicates are compounds which may be regarded as derived from silicic acids by replacement of the hydrogen by metals. Owing to the complicated nature of most of the silicates, however, they are more usually written as compounds of silica and other oxides, the real nature of the compound being unknown. They are almost all insoluble, the alkaline silicates being the only exceptions. Sodium silicate (NaSiO_3) is known as soluble glass, and its solution is employed for rendering wood, etc., fireproof. Many rocks consist almost entirely of silicates, as do most of the minerals which form the earth's crust. Glass also consists entirely of silicates; thus flint-glass consists of alkaline and lead silicates, other glass of silicates of calcium, sodium, potassium, etc. [GLASS, SILICA.]

Silicic Acids, acids from which the silicates may be regarded as derived, but which cannot be regarded as always existing free.

Silicon ($\text{Si} = 28$) is a non-metallic element which was first prepared by Berzelius in 1810. It is only prepared with difficulty, although its compounds are very abundant. Next to oxygen it is the most abundant element in the earth's crust, occurring, however, always in the combined state as silica or silicates. It may be obtained as a brown powder which burns if heated, forming the oxide silica. It may also be obtained in a crystalline form as black hexagonal tablets, somewhat resembling graphite, and also as octahedral crystals. It unites with hydrogen to form a gaseous hydride, and forms interesting chlorides, bromides, and iodides. In its chemical deportment it exhibits many striking similarities to carbon. Many organic compounds containing carbon thus are represented amongst silicon compounds, the only constitutional difference being the replacement of carbon by silicon. Thus, silico chloroform (SiHCl_3) corresponds to chloroform (CHCl_3), etc. Its oxide is known as silica (q.v.), and forms the basis of a large number of compounds known as *silicates* (q.v.).

Siliqua, a dry syncarpous superior fruit, typically made up of two carpels and two-chambered, though having parietal placentation (q.v.). It has a *replum*, or persistent septum, formed by outgrowth from the placentas, and valvular dehiscence, the two carpels separating from below, leaving the seeds attached to the replum. The siliqua is generally flattened, either parallel with the (broad) replum, when the fruit is termed *latisept*, or at right angles to the (narrow) replum, when it is called *angustisept*. The typical siliqua is elongated and pod-like, as in the cabbages, mustards, wallflowers, etc. When shorter than its breadth, it is called a *siliele* (silicula), as in the shepherd's purse (q.v.), the two varieties forming the typical fruits of the order Cruciferae (q.v.).

Exceptionally (*Tetrapoma*) there are four carpels; or the siliqua is transversely constricted between the seeds, as in radishes. It is then termed *lomentaceous*. A fruit much resembling a siliqua occurs in *Chelidonium* and *Glaucium*, belonging to the allied order Papaveraceae.

Silistria (Turkish *Dristria*), a fortified town in Bulgaria, Turkey, on the right bank of the Danube, 57 miles north-east of Shumla. It had been a place of military importance under the Byzantine emperors, but by the Berlin Treaty of 1878 it was dismantled. The Russians occupied it for some years after 1829, and they besieged it in 1854, but were vigorously repelled.

Silk (Anglo-Saxon, *seole*), a fibrous substance prepared from the cocoon of the silkworm, and used as the material of costly stuffs and garments. The name was derived through Latin, *sericum*, Greek, *sērikon*, from *sēr*, the Greek name of the silkworm, borrowed from the Chinese *sze* or *si* (in Korean *sir*). *Seres*, the name of the Chinese themselves, had the same origin.

The Silkworm. The silkworm is the larva or caterpillar of various moths belonging to the Bombycidae, Saturniidae, and other families of the order Lepidoptera. The most important is the *Bombyx mori*, a moth about an inch long (or in the case of the female somewhat larger), with dark wavy lines on its yellowish-white wings. It takes its name from the *morus* or mulberry-tree, the leaves of which form its principal food. The female lives but a short time after depositing her eggs on the leaves of the mulberry, and the males have also an ephemeral existence. The caterpillar, on emerging from the egg, is about $\frac{1}{4}$ inch long, but before entering on the chrysalis stage at the end of six or eight weeks it attains the length of 3 inches. It is a hairless yellowish-grey insect, with a peculiar horn-like protuberance near its tail. During the larva stage it casts its skin four times. When the time for spinning approaches, it ceases to take any food. The gummy substance from which the silk is produced is secreted in two long glands which run along each side of the body, and end in a single opening on the lower lip, called the "spinneret" or "seripositor." Under the microscope the *bare* or thread of the cocoon is seen to consist of two filaments (*brins*) ejected from the two glands, which are supposed to adhere together in consequence of their own glutinous properties. The cocoon is of a white or golden-yellow colour, and about as large as a pigeon's egg. The spinning occupies about five days, and is followed by a period of pupa life lasting some two or three weeks. The *Bombyx mori* produces but one generation annually; in other cases two or more are produced, but the silk is then inferior.

Cultivation of the Silkworm. Success in sericulture depends in great measure on the leaves on which the worms are fed. It is important that the quality should be good and the supply abundant—conditions which are best secured in a high situation and on a dry soil. In Europe the *Morus alba* is generally preferred to other varieties. The eggs are now hatched by stove-heat, the temperature

being gradually increased from 64° to 82° F. through a period of eight or ten days. Pieces of paper with small perforations are laid over the trays in which the hatching takes place, in order that the caterpillars may creep through the holes and thus rid themselves of portions of shell which might cause their death through constriction. It is important that the rearing-house should be roomy and well ventilated, and that overcrowding should be prevented, so as to allow each worm its due share of food and later on sufficient space in which to spin its cocoon. This is done in branches of brushwood or bundles of twigs placed for the purpose above the shelves or trays. If the silk is to be reeled, the moth must not be allowed to form within the shell and burst through the cocoon. The pupa is therefore killed by placing the cocoon in hot water or more usually in an oven heated by steam. The cocoons selected for breeding are laid on a cloth in a darkened room, the temperature of which ranges from 66° to 72° F. The sorter must be able to tell from the appearance of the cocoon whether the pupa is dead, and, if it lives, whether it will become a male or female moth, the sexes being distinguished by their difference in shape and size. Silkworms are liable to various diseases, the most important of which are *Pebrine* and *Muscardine*.

The Manufacture of Silk. Silk is either reeled or spun, the latter treatment being adopted only in the case of waste silk—i.e. damaged cocoons, the floss and husks of reeled cocoons, and the pieces of thread broken off in the processes of reeling and throwing, together with certain wild silks. Waste silk is spun into yarn in much the same manner as other fibres. The first step in the preparation of the better kind of silk is to place the cocoons in shallow basins of warm water, so as to soften the gum which holds the filaments together. The floss having been removed by means of a small brush made of twigs, the main filaments are caught, and, as they are unwound from their several cocoons, three or five are brought together so as to form a single strand, which is passed through an eyelet in the reeling machine. Care must be taken to preserve the thickness of the strand by supplying thread from a fresh cocoon when one of the former threads breaks or becomes exhausted.

The silk thus produced, called "raw silk," is made up into hanks. After the raw silk has been washed, it is subjected to a series of operations called "throwing," the purpose of which is to form it into stronger yarn. The hanks are first fixed on reels called "swifts," resembling those used in the former process, and as the swifts move the silk is wound on bobbins. The cleaning which follows is effected by passing the filament through a slit called the "cleaner," the silk being meanwhile reeled from one bobbin to another. This slit is the gauge of the thread, and presents an obstacle whenever there is any irregularity or coating of dirt. The silk is then passed over a smooth rod of metal or glass, and through a second guide to the bobbin on which it is wound. After this the thread is twisted so as to make it ready for doubling—i.e. removing the silk from several bobbins on to a

single large bobbin, which is placed in the throwing machine. It is there wound by a reel into hanks, which are subsequently wound on reels and bobbins for the weaver. Raw silk may be either: (1) "singles," consisting of one strand of twisted silk composed of the filaments of eight to ten cocoons; (2) "tram," in which two or three strands are combined without being twisted before doubling; (3) "organzine," composed of two or sometimes three twisted strands which have been spun in the opposite direction to that in which each was twisted.

History of the Industry. For many centuries sericulture and the manufacture of silken goods were confined to China. According to a Chinese work entitled *The Silkworm Classic*, Se-ling-she, wife of the Emperor Hwang-te, herself reared silkworms and caused the mulberry-tree to be grown and silk to be reeled as far back as 2640 B.C. The industry made its way through Corea to Japan at the beginning of the 3rd century of our era, and a little later it became known in India, whence it spread to Persia and the regions of Central Asia. In the early days of the Roman Empire raw silk and silken goods were imported extensively from the East, but the worm was not reared nor looms set up before the time of Justinian. Subsequently the silk trade fell into the hands of the Arabs, who introduced it into all their settlements from Asia Minor to Sicily. After the fall of that people it continued to flourish in Apulia, and was also planted in Florence, Venice, Genoa, and Milan, which maintained their celebrity as silk-producing towns throughout the Middle Ages.

Silk-weaving and the rearing of silkworms were introduced into France in the reigns of Louis XI. and Francis I., but did not prosper greatly; the extraordinary progress of the industry in that country at a later date was due to the protective policy of Colbert. The English manufacture, which had been established in the 15th century, received a great stimulus from the immigration of Flemish weavers in 1585, and still more from the influx of skilled French artisans which followed the revocation of the Edict of Nantes. These mostly settled in Spitalfields, and the industry afterwards extended to Coventry, Derby, Macclesfield, Congleton, Leek, and other provincial towns.

Since the French treaty of 1860, which admitted French silks duty free, the English trade has greatly declined. France holds the foremost rank among silk-manufacturing countries, contributing between one-third and one-half of the textures produced throughout the world; to a large extent these are made from raw silk produced on French soil.

Silk-Cotton, the silky hairs covering the seeds of the tropical American species of *Bombax*, a genus of Sterculiaceæ, an order related to the Malvaceæ, to which cotton belongs. That from *B. malabaricum* is known in Holland as *kapok*. Java exports over 1,500,000 kilogrammes, 40 per cent. going to Holland, 35 per cent. to Australia, and 22 per cent. to Singapore. It is used for stuffing beds, pillows, etc.

Silkworm. [SILK.]

Silliman, BENJAMIN, was born in Connecticut, United States, America, in 1779, and after being educated at Yale College, and making a tour in Europe, he settled down as professor of chemistry at that institution. In 1818 he started *Silliman's Journal*, for many years the chief scientific periodical in America, and he delivered hundreds of popular lectures on chemistry and geology. In 1853 he retired from his professorship, and brought out an interesting record of his last visit to Europe in 1851. He was a prominent abolitionist, but died in 1864, before his views had triumphed. His son, born in 1816, succeeded him as editor and professor, wrote several useful manuals, and died in 1885.

Silphidæ, a family of beetles belonging to the group Necrophaga, and including the largest of the "Burying Beetles;" these belong to the genus *Necrophorus*, which are often an inch in length. Some small members of the family are less than one-sixth of an inch in length; these belong to such genera as *Choleva* and *Colon*.

Silurian System, the name originally applied by Sir Roderick Murchison in 1835 to those rocks below the Old Red Sandstone that occupy the former territories of the Silures on the South Wales border. He afterwards extended the name downwards to all rocks below the Old Red Sandstone that contain trilobites, thus including the equivalents of the rocks described by Sedgwick under the name of Cambrian in North Wales. To obviate this conflict of nomenclature, when it had been shown by Mr. Etheridge that between the Archæan and the Old Red Sandstone there are three distinct faunas, the name Ordovician was proposed by Professor Lapworth for the Lower Silurian of Murchison or Upper Cambrian of Sedgwick. As now defined, the Silurian system is a series of sandstones and shales, with three bands of limestone, having a total thickness of from 5,500 to 7,000 feet, occupying in Britain a large area on the Welsh border, and in the Lake district, and found in deep borings to the north of London. Its subdivisions are as follows:—

	Feet.
<i>Ludlow Series</i> , with Kirkby Moor Flags and Bannisdale Slates.	
Ledbury Shales	300
Downton Sandstones	100
Upper Ludlow Shale with bone-bed	900
Aymestry Limestone	30-40
Lower Ludlow Shale	900
<i>Wenlock Series</i> , with Denbigh and Coniston Grits.	
Wenlock or Dudley Limestone	100-300
Wenlock Shale	640-1,400
Woolhope or Barr Limestone	40
Taranon Shale	1,000-1,500
<i>Upper Llandovery</i> , or <i>May Hill Series</i>	1,500

Besides May Hill, in Gloucestershire, the Lickey Hill quartzite, in Worcestershire, belongs to the Upper Llandovery sandstone series. The limestones of the Wenlock series, which though thin are crowded with fossils, are burnt into quicklime. The bone-bed in the Upper Ludlow, though less than a foot thick, is traceable over 1,000 square miles to the south of Ludlow. There is an unconformity at the base of the series, and though near

Ludlow it passes conformably up into the Old Red, in North Wales it has been tilted, crumpled, faulted, and cleaved before being covered by that formation. Land plants are represented in Silurian rocks; a fish has been found in the Lower Ludlow, and others occur in the bone-bed; Palæechinus, a sea-urchin, occurs in the Upper Llandovery; and Pseudocrinites, a cystidean, in the Wenlock Limestone. This light grey limestone is full of corals, crinoids, trilobites, and brachiopods, and also contains the eurypterids, *Eurypterus* and *Pterygotus*. The chief corals are *Omphyma*, *Favosites*, and *Halysites*; the chief trilobites *Calymene*, *Phacops*, *Homalonotus*, and *Illænus*; the chief brachiopods *Orthis*, *Rhynchonella*, *Strophomena*, *Atrypa*, and *Pentamerus*; and the chief cephalopod *Orthoceras*.

Siluridæ. [SILUROIDS.]

Siluroids, a large family (Siluridæ) of Physostomous Fishes, chiefly from the rivers and lakes of all temperate and tropical regions, though a few are coast fishes. The skin is without scales; barbules are always present, and there may be an adipose fin. The Sheat-fish (*Silurus glanis*), the European Siluroid, found in rivers east of the Rhine, attains a weight of from 300 lbs. to 400 lbs., and its flesh is well-favoured. [CAT-FISH, MALAPTERURUS.]

Silver (AG 107.93). This metal has been known since very early times; it is frequently mentioned in the Mosaic and other scriptural writings, while often in the other works of antiquity notice of it occurs. The sources whence the ancients obtained their supplies are not certainly known; Spain appears then, as now, however, to have been one of the chief seats of its production, while Nubia, Ethiopia, and Greece also possessed silver-mines. Small quantities only occur in Great Britain, though mention of former silver-mines is made by Strabo. The chief localities now noted for the presence of silver-ores are Spain, Hungary, the Hartz, the Urals, Saxony, Mexico, Peru, Colorado, Nevada, while it also occurs largely in numerous other districts. The metal seldom occurs in the free state, but is sometimes met with, crystallising in forms derived from the Cubic system. Its chief ores are the *sulphide*, or silver-glance, and *chloride*, or horn-silver. A crystalline compound with mercury is also found in Sweden, Spain, Chili, etc., which possesses a variable composition, and is known as "amalgam." The ores are usually associated with large quantities of other metals, so that they never contain more than a small proportion of the theoretical amount of silver. It occurs to a small extent in most lead-ores, and large quantities of the metal are obtained in lead-smelting, as the lead can be profitably desilverised when the proportion of silver is as low as a few ounces to the ton. [PATTINSON'S PROCESS, PARKES' PROCESS.] For the extraction of silver from its own ores, the methods are well perfected, and can be performed on ores with only .05 per cent. of silver. The processes differ, however, with the various ores and local conditions. Silver is, when pure, a bright white metal with a high lustre. It is very ductile and malleable, and is capable of being hammered

into very fine sheets and drawn into very thin wire. It has a specific gravity of 10·5 to 10·6, and is an excellent conductor of both heat and electricity. It melts at a temperature of 1,000° C., and at a higher temperature volatilises with the formation of a purplish blue vapour. It is very stable, and does not rust in moist air; it becomes coated, however, with a film of black sulphide if exposed to the action of sulphur compounds, and to this is due the blackening of silver articles in rooms where gas is burnt. It alloys very readily with other metals; the silver employed in English coinage consists of an alloy of 92·5 silver, with 7·5 of copper, most foreign coins containing a smaller quantity of silver. Silver containing 11 oz. 2 dwt. silver to the pound (Troy) is known as "sterling" silver, and is stamped with the "Hall mark" of a Lion, or if 11 oz. 10 dwt. (95·5 per cent.) of Britannia. If melted in air, silver absorbs oxygen to the extent of twenty-two times its volume, the whole being again liberated when the metal solidifies. It dissolves readily in nitric acid, forming *silver nitrate*, which crystallises in soluble triclinic tablets and is the most important salt of silver. Fused and cast in sticks, it is known as lunar caustic and employed as a cautery. The chloride, bromide, and iodide are all insoluble in water, and are extensively used in photography. The multifarious uses of the metal are too well known to need enumeration. It is usually detected by the precipitation of its insoluble chloride by hydrochloric acid, and may be estimated either in the same way or by the dry method known as *eupellation* (q.v.).

Simia, a Linnean genus comprising all the apes and monkeys, now restricted to the Orang Outan (q.v.).

Simla, a British sanatorium, the capital of a district of the same name, in the division of Ambala, Punjab, India. The district has an area of 18 square miles, and occupies a spur of the Central Himalayas. The town of Simla is situated in fine mountain scenery, 7,084 feet above sea-level and 170 miles N. of Delhi, whence it is accessible by railway. Owing to its fine climate, it has been for over thirty years the seat of the Government of India during the summer months.

Simon, or SIMEON, the son of Cleophas and Mary, spoken of as the brother of Jesus, was one of the first disciples. After the death of James he was elected bishop of the Church of Jerusalem, which he governed for over forty years, suffering martyrdom, so tradition tells us, under Trajan about 107 A.D.

Simon, JULES, or JULES FRANÇOIS SIMON SUISSÉ, was born in 1814, and became a teacher at Rennes, whence he passed to the École Normale in Paris at the invitation of Victor Cousin, whom he succeeded as Professor of Philosophy. In 1846 he left literature for politics, founded *La Liberté de Penser*, and entered the Chamber in 1848, joining the Moderate Left. The *coup d'état* for a time excluded him from public life as a teacher or a legislator, but in 1863 he was returned as deputy for the Seine, and at once took the lead of the

Ultra-Liberals and Free Traders. In the Government of the Defence he became Minister of Public Instruction, Worship, and Fine Arts, and resumed that post under M. Thiers. In 1875 he was chosen a life senator, and at the end of the year formed a Ministry, which lasted until 1877. In 1879 he opposed Ferry's bill for suppressing non-authorised religious bodies, and he has since taken a strong interest in labour questions and the development of Socialism. He was made an Academician in 1875 and secretary of the Moral Science branch in 1882. His early works deal chiefly with Platonic philosophy; but he has since written many able monographs on public questions.

Simonides of Ceos, a Greek philosopher and poet, who flourished about the close of the 6th and beginning of the 5th century B.C. He excelled in elegiac verse, and is said to have competed successfully against Æschylus. SIMONIDES OF AMORGOS, a satirical poet, lived a century earlier.

Simon Magus, or the SORCERER, a native of Samaria, and probably a Gnostic, was practising his art in his native country when Philip began to preach and perform miracles. Simon professed to be converted and was baptised, but, on his offering money to Peter for the gift of the Holy Spirit, he was excommunicated. He then returned to his old errors, upon which he grafted a system of his own—the Æons or intermediate spirits, governing the world under the Supreme Deity, being one of his inventions. The ecclesiastical sin of simony derives its name from him.

Simon Zelotes, or THE CANAANITE, is an apostle of whom little is recorded. The two names by which he is known are really identical, and probably indicate that he belonged before his conversion to a fanatical and lawless sect among the Jews. He was the brother of Jude.

Simoon is a hot wind occurring in the hot sandy regions of Africa and Arabia. The sand, under the scorching rays of the sun, gets extremely hot. It is too bad a conductor to allow the heat to pass downwards, and the absence of water prevents it from becoming latent in atmospheric moisture. Hence the top layers get enormously hot, the temperature sometimes rising to 200° F., nearly the boiling-point of water. Currents of hot air rise, and more air rushes in to supply their place; the result is that hot columns of air, laden with stifling clouds of sand, are swept across the country, causing immense destruction to animal and vegetable life. Extensive caravans are often destroyed, and even whole armies have been known to perish before it. Its advent is usually signalled by the appearance of a rapidly-spreading haze, extending from the horizon till the whole sky is obscured by it; then follow hurricanes with their fearful columns of heated sand. The sirocco of Italy, solano of Spain, and samiel of Turkey are merely modifications of the dread simoon. The hot winds of the Sahara get saturated with vapour in their passage across the Mediterranean, and appear as the hot, moist, enervating sirocco of Sicily and Italy.

Simplon (German *Simpeln*), a mountain pass in the E. of the canton of Valais, Switzerland, forming part of the Lepontine Alps. The famous road, 38 miles in length, and reaching a height of 6,885 feet, leads from Brieg, Valais, to Domo d'Ossola, Piedmont. It was constructed by Napoleon between 1801 and 1807. A railway tunnel, which would be the longest in the world (about 11 miles), has long been in contemplation.

Simpson, Sir James Young, Bart., M.D., was born at Bathgate, Linlithgowshire, in 1811, and educated at the university of Edinburgh, where in 1846 he filled the chair of obstetric medicine. In 1847 he published his great discovery of chloroform as an anæsthetic, having personally gone through a series of hazardous experiments to prove his point. His reputation became at once European, and many honours were bestowed upon him. In 1866 he received a baronetcy. Several other surgical improvements are due to him, especially the introduction of acupressure for arresting hæmorrhage. He was also a keen archæologist. He died in 1870.

Simrock, Karl Joseph, born at Bonn in 1802, devoted himself to the study of early German literature, and in 1827 produced an edition of the *Nibelungenlied*, which was subsequently enlarged and improved. In 1850 he was appointed professor of literature at Bonn, and edited the chief poems and legends of the Fatherland, *e.g.* *Parsifal*, *Reineke Fuchs*, *Tristan und Isolde*, the *Minnesingers*, and the *Wartburgkrieg*. He also translated Shakespeare, and the *Frithiof Saga*, besides writing much original verse. He died in 1876.

Sinai, Mount, a name given vaguely to the mountain group that occupies the triangular area between the Gulfs of Suez and Akabah. Horeb is the northern buttress of this mass, and Jeb-el-Musa, at its southern extremity, is usually identified with the Sinai where Moses received the tables of the law. The height is about 7,500 feet, and on its eastern flank stands a famous Greek monastery. Beke, however, contends that the Sinai of the Bible lay nearer the Gulf of Akabah.

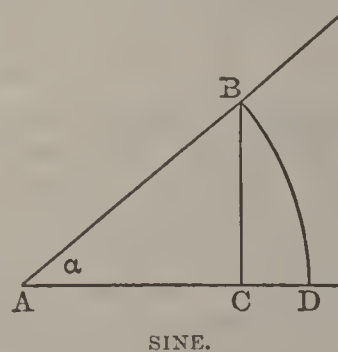
Sindh, or SINDE, a province of British India, occupying an area of more than 54,000 square miles, within which is included the valley of the Indus from Shikarpur to the sea, and the less important basin of the Narra, and the sandy tracts to the E. with the mountainous district on the Beluchistan frontier to the W. The upper parts, under a system of irrigation, are moderately fertile, but the extensive delta of the river yields support for the camel only. In many physical aspects the country resembles Egypt. Before 1843 it had been ruled by various semi-dependent chiefs, but in that year, after endless disputes, they were brought under British rule by Sir Charles Napier. The province was then divided into five districts, and placed under a Commissioner, who is subordinate to the Bombay Government, and has his administrative headquarters at Karachi. The only other places of importance are Haiderabad, Sukkur, Shikarpur, and Nowsheera. Sindh produces little

for exportation except embroidered cloths, nitre, timber, hides, and seeds. Most of the goods shipped at Karachi come from the north and west.

Sindia, or SINDHIA, the name by which the Mahratta Maharajahs of Gwalior are hereditarily designated. The fortunes of the family were founded by a humble peasant who was taken into the Peishwa's service early in the 18th century. His descendant, DAULUT RAO SINDHIA, who succeeded to the throne in 1794, aspired to make himself the head of the Mahratta Confederacy, and, having a fine army (mainly organised by Frenchmen), began, with his ally, the Bhonslah of Berar, offensive operations in 1802. He was defeated by Wellesley at Assaye and Argaum in 1803, and both Gobad and Gwalior were captured by Lake. Temporarily pacified, he showed sympathy with the Pindaris in 1817 and lost Assegahr in consequence. He died childless, as did his successor, JANAKJI, a nominee of the British Government. BAJORAT RAO SINDHIA, the present ruler, was a distant cousin of Janakji, and succeeded in 1843 as a boy of eight. Protected during his minority by the British, he has remained faithful ever since, though driven out by his rebellious troops during the Mutiny. He received the Prince of Wales in 1876, and has since visited England himself.

Sine is a trigonometrical ratio by means of which an angle can be measured. If from any point B in one line bounding an angle A, a perpendicular BC be dropped on to the other line, then the ratio $\frac{BC}{AC}$ is called the *sine* of the angle A.

With A as centre and radius AB, we describe the arc BD of a circle, then the old definition of sine referred to it as a function of the arc BD, while the *line* BC—not the ratio used above—was said to be the sine of BD. The length, BC, varied with the radius of the circle, but the modern



definition overcomes this difficulty, for

$$\text{sine of the angle } A = \frac{\text{sine of the arc}}{\text{radius of the circle}}.$$

Singapore, the chief island of the Straits Settlements (q.v.) and its capital. The former lies off the S. extremity of the Malay Peninsula, from which it is divided by a channel less than a mile broad, and is 25 miles long by 14 broad. It was acquired in 1817. The surface is low, undulating, and jungly. The rich soil yields cocoa-nuts, gambia, and all sorts of tropical fruits. The capital is on the S. coast, the roadstead affording safe anchorage. Founded in 1819, it has become one of the most important commercial centres of the East, serving as a depôt for all the exports of Farther India, China, and the Indian Archipelago, and for the imports taken by those countries from Europe. Camphor, indiarubber, rice, spices, coffee, sago, pepper, canes, hides, and tortoise-shell are among

the chief articles of trade, which is largely conducted by Chinese. It has an Anglican bishop.

Singhalese, the inhabitants of the southern half of Ceylon, the northern half being occupied by Tamil intruders from India, take their name from *Singhaladvipa* ("Lion Island"), one of the old designations of Lanka (Ceylon) in the Hindu writings; Ceylon itself is a corrupt form of the same word. The Singhalese appear to be a mixed Aryo-Dravidian people, conquered and civilised at an early date by the Hindus. About 300,000 are Roman Catholics, converted during the Portuguese occupation of the island, and 212,000 Moham-medans, converted by Arab missionaries at an earlier period; the rest are Buddhists, Ceylon having remained the chief stronghold of Buddhism in the south after its suppression on the mainland. They are a mild, inoffensive, and somewhat indolent people, who are being slowly encroached upon by the Tamils of the northern districts.

Sinking Funds are formed by setting aside revenue specially for the repayment of national debt. Walpole introduced the first (1716). In 1786 Pitt, misled by the arguments of one Dr. Price, devoted £1,000,000 annually to purchasing Government stock, to be held by commissioners who were to re-invest the interest similarly. Thus, it was argued, the fund would increase at compound interest. This, however, kept the debt unreduced and so forced up the rate of interest on fresh loans, and was stopped in 1829. Since then attempts have been made to reduce the debt directly out of surplus revenue (as by Sir S. Northcote in 1875), but it is generally held to be unadvisable to accumulate a fund for the purpose, as the temptation is so great to use it otherwise in emergencies.

Sinope (Turkish *Sinub*), a seaport on the S. shore of the Black Sea, in the province of Anatolia, Asiatic Turkey. Colonised at least five centuries before Christ by Greeks from Miletus, it was an important place until the decay of Greek and Roman civilisation. It still possesses a naval arsenal, and enjoys some trade in timber, salt, cordage, fish, and oil. Here in 1853 a Turkish fleet was destroyed by a superior Russian force. This was one of the immediate causes of the Crimean War.

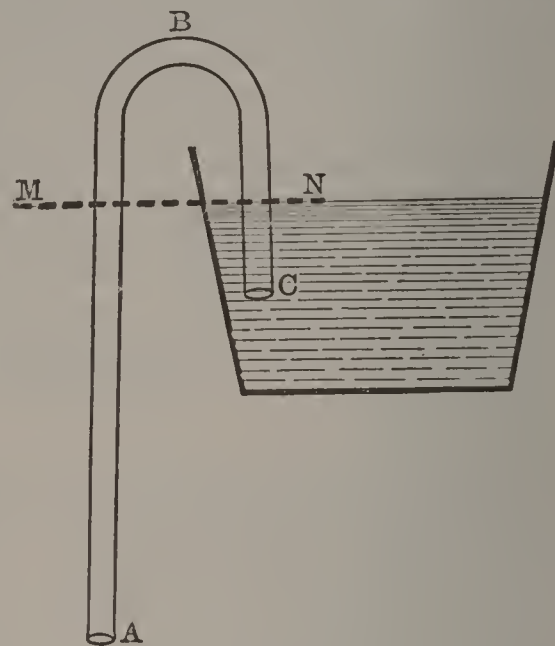
Sinus. The term "sinus" is sometimes applied to the cavities which are met with in bones, as, for example, the frontal sinuses; the expression "venous sinus" is used to denote the dilated channels which occur in certain situations, particularly in the skull, and which serve for the transmission of venous blood. [FISTULA.]

Siouan. [SIOUX.]

Sioux, one of the great families of the North American Indians, whose chief divisions are given under DAKOTAS (q.v.). To these must be added the Omahas, Poncas, Kaws (Kansas), Osages, Quapaws, Iowas, Otoes, Missouri, Winnebagos, and Mandans, all now removed to reservations in Nebraska, Indian Territory, Kansas, and Dakota. Total population (1890), 43,400, of whom about 2,200 are in British North America, the rest in the

United States. The term "Sioux," now applied under the form *Siouan* to the whole family, is a Franco-Canadian mutilation of the Algonquin word "nadowe-ssi-wag" ("the snake-like ones," "the enemies.") (Powell, *Indian Linguistic Families*, Washington, 1891.)

Siphon is a bent tube used to remove liquids from vessels when it is inconvenient to disturb the vessel. One end of the siphon dips into the liquid; the other end is outside the vessel and is lower



SIPHON.

than the surface of the liquid inside. The tube may first be filled with the liquid, and the ends C and A closed, while it is inverted and placed in the position illustrated in the diagram. On opening the ends, liquid will flow from A as long as C is immersed. As the liquid issues from A, it tends to form a vacuum at B, but the pressure of the atmosphere at the surface N of the liquid forces more fluid up the tube, and so the flow goes on. If M N be the level of the liquid, there is at A the pressure of the atmosphere, together with the head of liquid M A, tending to drive the liquid out, while only the atmospheric pressure is tending to prevent its fall. The difference between the two is the head of liquid M A, and the liquid issues at that pressure. The height of B above N must not be greater than the height of a column of liquid, which is just supported by the pressure of the air, or the tube B A will simply empty itself. If the liquid be mercury, this height must not exceed about 30 inches, and if water the limit is about 33 feet.

Siphonoglyphe, the ciliated groove or furrow at one or both ends of the mouth of various members of the Actinozoa (q.v.) or Alcyonaria (q.v.). By the vibration of the cilia a current of water is started, and food and fresh water are carried down into the œsophagus. It thus serves both for respiration and nutrition. It can be well seen both in the Sea-Anemones or in *Aleyonium*, the "Dead Men's Fingers."

Siphonophora, an order of Craspedote (q.v.) Hydrozoa, including a number of forms which live on the surface of the seas, mostly in the tropics.

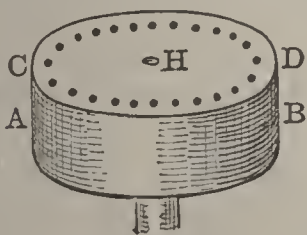
They are colonial in habit, and the colonies are characterised by very marked polymorphism, *i.e.* the different zooids are specialised to serve different functions. They are all free, and as a rule the stem is unbranched, but is often expanded into a float or pneumatophore. The order is divided into four sub-orders:—(1) The Physophorida (q.v.), including *Physophora* and others with flask-shaped floats; (2) Physalida, including the Portuguese Man-of-War or *Physalia*; (3) Discoidea, with disc-shaped floats, such as *Velella* and *Porpita*, and (4) Calycophorida, in which the zooids are placed on an elongated, tubular coenosarc, as in *Diphyes*, *Abyla*, etc.

Siphonozoids, those individuals in an Alcyonarian (q.v.) which are much simpler in structure than the normal individuals (autozooids). They have no tentacles or retractive muscles, and are without reproductive organs. Among the Alcyonaria they occur in the Helioparidæ or Blue Corals, Pennatulidæ, and in some Alcyonidæ.

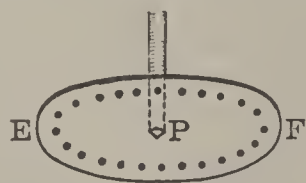
Siphuncle, the long membranous tube which passes back through the shell of a Cephalopod (q.v.), such as the Nautilus, and establishes a connection between the different chambers. Where it passes through the septa, prolongations of these, known as "collars," pass back and protect it. The position of the siphuncle is of considerable importance, as in Nautilus and its allies it passes through the centre of the septa, while in the Ammonites it cuts them at the margin.

Sipunculus, a genus of worms belonging to the class Gephyrea (q.v.), and the type of the family *Sipunculidæ*. The three main characters of the family are that the worm consists of only one segment, has no hairs or setæ, and has tentacles around the mouth. A vascular circulatory system is present in most members of the family, and its structure led to the view that *Sipunculus* and the Gephyreans might be allied to the Holothurians or Sea-Cucumbers.

Siren is an instrument which produces a sound by converting a steady current of air or some other gas into a series of discontinuous puffs. This may be done by an arrangement such as that shown in



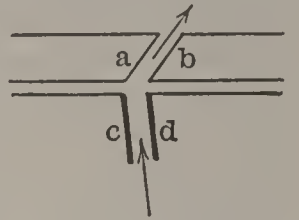
SIREN.—Fig. 1.



SIREN.—Fig. 2.

the illustration. A B (Fig. 1) is a cylinder whose top consists of a disc C D perforated by a number of holes. Another disc E F (Fig. 2) will exactly fit over C D, and by means of a pin in the centre P, which can rest in slight hole at H, the top disc can rotate quite freely over the lower one. The number of holes in E F and C D is the same, but their directions are different. If *c d* and *a b* (Fig. 3) be holes in the lower and upper disc, a stream of air sent up *c d* will strike the side *a* of the upper

orifice and so cause the movable disc to rotate. This effect is proportional to the number of perforations in the two discs, since they are all superposed at the same moment. By merely sending air up the tube into the cylinder the upper disc rotates, and, as it moves, the holes in upper and lower discs are constantly changing from positions of coincidence to disagreement. Hence the air can only issue from E F in puffs, and these puffs produce a certain note. The siren can



SIREN.—Fig. 3.

be used to determine the number of vibrations in a note produced by any means; it is then provided with an apparatus which registers the number of revolutions in any time, and with an adjustment for increasing or decreasing the number of orifices. When the siren is producing a sound exactly in agreement with the other, the number of vibrations per second in both is the number of revolutions of the disc per second multiplied by the number of holes in use. Sirens are frequently used as fog-horns on ships and in lighthouses.

Siren (*Siren lacertina*), a tailed Amphibian, the sole species of its genus, from the swamps of the southern states of the American continent. The form is eel-like, hind limbs are absent, and gills persist throughout life.

Sirenia, an order of Aquatic Mammals, resembling the whales and dolphins in form, but without close relationship, though they were formerly classed together. The only living Sirenians are the Dugong and the Manatee (both which see). [HALITHERIUM, RHYTINA.]

Sirius, the brightest star in the sky, is more commonly known by the name of the Dog-star, since it occurs in the constellation known as Canis Major. Seen through a powerful telescope, Sirius is brilliantly white, and the light is so dazzling that the effect on the eye is as painful as that produced by directly gazing at the sun at noon. A small, darker star was discovered by Mr. Clark, of New York, in 1862, and observed to revolve with Sirius about a common centre, the motion of each influencing that of the other. The motion of Sirius has been shown to be undulatory, the star moving on each side of a mean position. Since Sirius is so bright an object in the sky, it was, of course, known to the ancients, and became the object of many myths and superstitions, of which the tales of the Dog Days are survivals.

Sirocco. [SIMOON.]

Siskin, a book name for finches of the genus *Chrysomitris*, with eighteen species, from the Neotropical and Neartic regions, Europe and Siberia. The Common Siskin, or Aberdevine (*C. spinus*), a British winter visitor, remaining to breed in parts of Scotland, is a common cage-bird, a little less than five inches long, with yellowish-green plumage, marked with black above; the under parts are white.

Sismondi, JEAN CHARLES LÉONARD SIMONDE, was born in 1773. Part of his youth was spent in England and in Italy; but he returned to Geneva in 1800, entered the Representative Chamber, and resisted ultra-democratic movements. His first volume, *A Picture of Tuscan Agriculture*, appeared in 1801, and was followed by a treatise on *Commercial Wealth*, based chiefly on Adam Smith. From 1807 to 1818 he was engaged on his great work, *The History of the Italian Republics of the Middle Ages*, but found time for various other publications on economical and moral science, and for beginning his *History of the Literature of Southern Europe* and *History of the French*, the last of which he did not live to complete. He visited France in 1813, and his relations with two such opposite characters as Napoleon and Mme. de Staël were somewhat remarkable, and did not tend to make him popular at home. He died in 1842.

Sisyphus, in Greek mythology, was the founder and king of Ephyra (Corinth), but a man of notorious cruelty and immorality, as a punishment for which he was condemned, after his death at the hand of Theseus, to roll eternally uphill a huge block of marble, which no sooner reached the top than it rolled down again.

Siva, or SHIVA, the third person in the Hindu Trinity [BRAHMA, VISHNU], representing the destructive power of the universe as opposed to the creative and vivifying forces. The worship of Siva is by some believed to have been a later addition to pure Brahminism, only appearing in the Puranas and Tantras, and associated with the gloomier aspect of the faith, involving cruel and mysterious rites. Durga or Devi [KALI], his consort, is especially propitiated by self-inflicted torture. Gradually, however, Siva, growing more popular, supplanted Vishnu as the latter had supplanted Brahma, and was credited with the beneficent qualities of his partners in divinity. The destroyer thus only exercises his power with a view to renewal of life, and the patron of hideous sacrifice becomes the teacher of ascetic virtue. He is represented with five heads and three eyes, a crescent on his brow, his hair drawn to a horn-shaped peak and entwined with the folds of the Ganges. He rides on the bull Nandi, wears a necklet of skulls, and carries a trident of human bones. His home is on Kailása, a remote Himalayan summit. Among his other names are Kala ("black"), Mahadeva ("Great God"), and Maheshwara ("Great Lord").

Sivalik Hills. [HIMALAYAS.]

Sixtus, the name by which five Popes have been known in history. Chief among these was SIXTUS V. (FELICE PERETTI) who began life in 1521 as the son of a poor gardener at Ancona, entered a Cordelier monastery as a servant, educated himself diligently, was admitted to orders under the pseudonym of Montalto, obtained the red hat in 1570, and succeeded to the chair of St. Peter in 1585. His reign was marked by great vigour. He embellished Rome with fine buildings, beginning the dome of St. Peter's, enlarging the Vatican

Library, and constructing a great aqueduct. He excommunicated Elizabeth of England and Henry of Navarre, and, dying in 1590, left an enormous fortune to the Holy See.

Skager-Rack, or THE SLEEVE, an arm connecting the North Sea with the Cattegat, and separating Denmark from Norway. It is about 150 miles long, with an average breadth of 80 miles, and is remarkable for strong and dangerous currents.

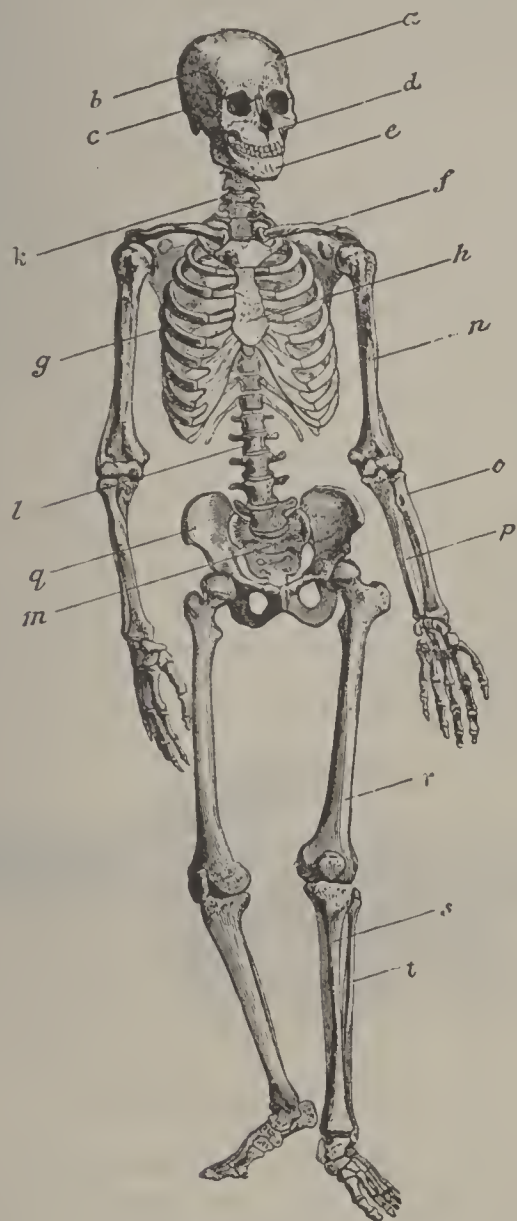
Skate, a popular name for those fish of the Ray genus, in which the snout is long and pointed. The True Skate (*Raja batis*) is very common round the British coast; the Long-nosed Skate (*R. vomer*), with the snout greatly prolonged; the Berston Skate (*R. marginata*), and the Shagreen Skate (*R. fullonica*), are also British. Allied species are found on the American coast. The flesh is used for food, but is not esteemed.

Skating generally signifies gliding over the ice by the aid of a blade of metal, attached to a metal or wooden framework, fastened to the sole of each foot. It is also sometimes applied to the Norwegian *ski*, which enables the wearer to pass over snow, and is much employed in the drill of northern armies. Skating is of very ancient origin, and has for centuries been a favourite pastime in England and Holland. Canada has followed it up warmly, and it is in that colony that the skating-rink originated. The types of skate are many, from the mutton-shank of the ancient London apprentice to the Acme and Austrian skate of the present day. The principle has been applied to the construction of the roller-skate, which is available upon asphalt or other smooth surfaces.

Skeat, WALTER WILLIAM, was born in 1835, and graduated at Cambridge, becoming in 1864 lecturer in mathematics at his college (Christ's). He had already turned his attention to the study of English philology, and edited between 1865 and 1872 many specimens of our early literature for the English Text Society. He was also employed to continue Kemble's Anglo-Saxon Gospels for the Cambridge Press, and to edit parts of Chaucer for the Oxford Press. In 1873 he founded the English Dialect Society, and in 1878 was appointed Professor of Anglo-Saxon at Cambridge. His *Etymological Dictionary of the English Language*, published in 1881, and his edition of Chaucer, are most valuable works.

Skeleton. The human skeleton consists of some 200 bones, though the number of separate bones varies at different times of life, bones which are distinct in early life becoming fused in old age. The vertebral column is made up in adult life of 26 separate bones, and is divided into a cervical portion (see Fig. *k*), a dorsal portion, to which the ribs are attached, a lumbar portion (see Fig. *l*), the sacrum (see Fig. *m*), and the coccyx. The sacrum originally consists of five, and the coccyx of four, distinct vertebræ. The nine vertebral, together with the five lumbar vertebræ, the twelve dorsal vertebræ, and the seven cervical vertebræ make up a total of 33 vertebræ; or, taking account

of the fusion of originally separate vertebræ already alluded to, the total of 26 separate bones in the entire vertebral column is accounted for. Poised on the summit of this column is the skull. In the figure the letter *a* denotes the position of the frontal bones, which form the anterior wall of the cranial vault; *b* indicates the situation of the



HUMAN SKELETON.

laterally-placed parietal bone, and *e* of the temporal bone, which lies beneath each parietal bone; *d* indicates the superior maxillary bone, and *e* the inferior maxillary bone. The shoulder girdle is made up of the clavicle or collar bone (*see* Fig. *f*), and the scapula, or shoulder-blade on either side. The clavicle articulates with the scapula, and the articulation of the rounded head of the humerus with the glenoid cavity of the scapula constitutes the shoulder joint. The ribs, 12 in number on each side (*see* Fig. *g*), make up the bony framework of the thorax, and, with the exception of the lowermost floating ribs, they are united to the sternum (*see* Fig. *h*) by the several costal cartilages. The bones of each upper extremity are 64 in number; in the upper arm is the humerus (*see* Fig. *n*), in the fore-arm are the radius (*see* Fig. *o*) and the ulna (*see* Fig. *p*); and then follow the bones of the carpus and metacarpus, and the phalanges. The hip girdle is formed by the pelvis (*see* Fig. *q*), and the hip-joint on

either side is constituted by the articulation of the head of the femur with the acetabulum, the cavity which exists on each of the lateral aspects of the pelvis. Each lower extremity contains in all 62 bones. The thigh-bone is called the femur (*see* Fig. *r*); the bones of the leg are the tibia (*see* Fig. *s*) and the fibula (*see* Fig. *t*); and then follow the bones of the tarsus, the metatarsus, and the phalanges.

Skelton, JOHN, was born about 1460, showed remarkable promise as a scholar, won the patronage of Margaret Tudor, the learned mother of Henry VII., and was appointed tutor to Henry VIII. About 1500 he took orders, and held till his death the living of Diss in Norfolk. His first poem was on the death of Edward IV. in 1483, but his genius lay in the direction of boisterous satire, ribald merry-making, and Rabelaisian wit. In *Colin Cloute* he assails the Church unsparingly, and in *Why come ye not to Court?* he makes Wolsey, then in the zenith of power, the butt of fearless ridicule. *The Barge [Barge] of Court* deals with the follies of the day in a less personal form, whilst *The Book of Philip Sparrow* shows his lighter moods in a pleasant shape. It is said that Wolsey's wrath compelled him to seek sanctuary at Westminster, where he died in 1529.

Skimmer, any bird of the genus *Rhynchops*, of the Gull family, with two species from the Old World and one from the New. The bill is long and thin, and, the lower mandible being the longer, the upper serves to scoop up small fish as the birds skim along the surface of the water.

Skin. The skin consists of a vascular layer called the corium, or true skin, and of the epidermis (q.v.). The corium presents innumerable raised conical elevations, known as papillæ, which contain the various nerve terminations concerned with the sense of touch. The skin also contains glands, and these are of two kinds: the sudoriferous or sweat glands, and the sebaceous glands. The skin is, moreover, beset with hair follicles, which attain a remarkable development in certain parts, more particularly in the hairy scalp, and it is in connection with hairs that the sebaceous glands for the most part occur. In certain parts the structure of the skin is modified, notably so in the nails of the fingers and toes. The skin serves to protect internal parts from injury; it is the organ concerned with tactile sensation, and is, moreover, an excretory organ. [SWEAT.] The skin undoubtedly possesses the power of absorbing substances which are rubbed into it; and the action of certain drugs upon the system is brought about sometimes by the method of inunction. There has been some difference of opinion as to the extent to which liquids brought in contact with the body are absorbed by the skin; such absorption probably occurs, though it is much less marked in man than in some of the lower animals. Finally it may be noted that the skin plays an important part in the regulation of the temperature of the body.

Skink, a popular name for *Scincus officinalis*, an African lizard from six to eight inches long,

reddish-dun in colour, marked with transverse dark bands. The name is also used for any member of the family Scincidæ, in some of which the limbs are rudimentary, and in others altogether absent.

Skirret (*Sium Sisarum*), an umbelliferous plant, native to China, which has been cultivated in England as a vegetable since 1548, but is now little known. The roots, which form the edible portion of the plant, are fasciculate tubercles, and are eaten, boiled, with butter.

Skittles, a game now much fallen into disuse, is played generally in a specially-arranged alley. It is played with a disk or ball one foot in diameter, which is hurled by the player at a set of nine pins, each one foot high, in a square each side of which contains three balls, while the ninth occupies the centre. He who upsets most pins wins. An American variety has ten pins, and the ball is rolled along a central plank. In some parts the game is called Kails. (*Cf.* German *kegel*, and French *quilles*.)

Skobelev, MICHAEL DIMITRIEVITCH, was born in 1843, and, entering the Russian army, soon made his mark. In 1868 he was sent on the staff to Turkestan, and he led the van of Lomakine's army to Khokand in 1873, reducing the province and becoming its governor in 1876 with the rank of major-general. On the outbreak of the Russo-Turkish War he joined the staff of the Grand Duke Nicholas, and did brilliant service at Plevna and Adrianople. In 1880 he was once more in Central Asia, capturing Geok Tepe and playing havoc with the Tekke Turcomans. Recalled by the Czar, he took the opportunity during a visit to Paris in 1882 to make a violent Panslavist speech, threatening Germany with war. He was summoned back to St. Petersburg, and five months later died very suddenly.

Skua. [GULL.]

Skull. The skull consists of twenty-two separate bones, eight of these forming the cranium, and the remainder entering into the constitution of the face. Below and at the back part of the skull is situated the occipital bone. In front of this, and entering into the formation of the basal part of the skull, are the sphenoid and the ethmoid bones; the lateral aspects of the cranial vault are formed by the two parietal bones, and in front of these are the two frontal bones. The temporal bone of either side lies below the parietal and in front of the occipital bone, its anterior margin articulating with a portion of the sphenoid bone. The fourteen bones of the face consist of the pairs of nasal, superior maxillary, lachrymal, palatine, inferior turbinated, and malar bones, with the single vomer and the inferior maxillary bone. The bones of the cranial vault are closely united with one another, the intervening *sutures* being markedly serrated. The suture which separates the frontal from the parietal bones is termed the coronal suture, while that which intervenes between the two parietal bones is called the sagittal suture. Various holes (foramina) perforate the base of the skull, and allow of the exit of the cranial nerves and the blood-vessels. The largest of these is the foramen

magnum in the occipital bone, and through it passes the medulla oblongata which connects the brain with the spinal cord. The spaces which remain unossified at birth, in the middle line of the skull at the anterior and posterior extremities of the sagittal suture, are called the fontanelles; the anterior fontanelle is not completely closed by bony growth until the first or second year after birth. The posterior fontanelle is closed within a few months of birth. There are also two lateral fontanelles situated at the anterior and lower angles of the parietal bones; these, however, become completely ossified very shortly after birth. The skulls of different racial types present distinct peculiarities, which have been made to serve as a basis of classification. The brachycephalic skull is a skull whose breadth is great in proportion to its length, and the dolichocephalic skull is one in which the breadth is less considerable in proportion to the length; the mesocephalic skull occupies an intermediate position between these two extremes.

Skunk, any individual of the genus *Mephitis*, of the Weasel family, with three species, ranging from Canada and British Columbia to Guatemala. The general coloration is black and white, in broad longitudinal masses, the under surface being black, and the tail is bushy. In these animals the power of discharging the offensive contents of the anal



SKUNK (*Mephitis mephitis*).

glands reaches its highest development, and the secretion is so foetid that its odour can be perceived at a considerable distance, and often causes nausea, and clothes soiled with it can only be cleansed after repeated washings or hanging in smoke. Skunks are nocturnal animals, living on the ground or in burrows, and feeding on small mammals, birds, reptiles, insects, worms, roots, and berries. The Common Skunk (*M. mephitis*) is about the size of a small cat, and ranges from Hudson's Bay to Guatemala. The Long-tailed Skunk (*M. macrura*) inhabits Central and Southern Mexico, and *M. putorius* ranges from the southern states to Guatemala. *Conepatus mapacito* (formerly classed with the True Skunks) is more stoutly built, with a pig-like head. It ranges from Texas to Patagonia.

Skupshchina, the name of the National Assembly of the Servians. Often spelt *Skuptchina*.

Skye, ISLE OF, the largest of the Inner Hebrides, lies off the N.W. coast of Inverness-shire, Scotland, from which it is separated by the Sound of Sleat, not more than half a mile broad in its narrowest part. It is 48 miles long, but of variable breadth, being indented by Lochs Snizort, Follart, Bracadale,

etc. The area is about 547 square miles, mostly rocky and mountainous, the Cuchullin Hills attaining more than 3,000 feet. Very little of the land is suited to agriculture, and even the pastures are coarse. Freestone, granite, and marble are quarried, but the population subsists chiefly on the export of sheep, cattle, fish, and kelp or seaweed. Tourists are attracted hither by the bold scenery of the basaltic rocks that fringe the N. coast, and by the ancient Norse monuments. Portree, the capital, lies to the E., and is little more than a large village.

Skye Terrier, a variety of the Scotch terrier, the origin of which is unknown. In this breed the body is very long, the limbs short, and the coat, which should be quite straight, so long as almost to touch the ground when the animal walks. The colour is usually slate or fawn. These dogs, which are kept as pets, require a great deal of attention, or the long coat will soon become anything but an ornament.

Slag. In the smelting of a metal a flux (q.v.) is usually added to the ores, which combines with the siliceous and earthy impurities of the ores to form a fusible substance, which floats above the metal and can be tapped off or withdrawn, and which is known as *slag*. The slags vary in composition, according to the nature of the ores and flux. They are usually mixtures of silicates of lime, soda, potash, iron, etc., and are generally vitreous compounds, closely resembling many of the lavas and volcanic rocks.

Slander is a false and malicious statement concerning anyone made by word of mouth. It gives rise to a right of action for damages if it imputes the commission of a crime for which a corporal punishment may be inflicted, or the having some contagious disorder which may exclude the person in question from society, or if it has reference to his trade, office, or profession, and is calculated to injure him in such, or if it has caused him special damage.

Slang, used generally to denote a method of speaking in which either artificial words are used to denote ordinary objects, or in which words are employed in other than their ordinary senses. Under the former of these heads may be included the patter of gipsies and vagrants, thieves' Latin, and the *cant*, as it is called, by which many try to conceal their meaning from the uninitiated. The true Gipsy, *i.e.* Romany, is not slang but a distinct Eastern dialect, though it is much corrupted, and many slang words have been introduced into Romany, while many Romany words have been introduced into slang. Many slang words, again, are Old English, or Norse, or Celtic. The word is said to mean, by derivation, *secret language*. Every class of society has its slang in the second sense of the word—that is, uses in speech, either from affectation, or with a deliberate intention to produce an effect ludicrous or otherwise, a language that it would not use in oratory or in serious writing. Slang is often merely metaphor; for instance, when a Winchester boy speaks of "Moab" for the washing-place, he is using a metaphor arising from a mistaken conception of a Scriptural expression.

Slang dictionaries have been compiled, and are of interest to the philologist.

Slate, a cleaved, compact, argillaceous rock, which has been to some extent metamorphosed, and is obtained generally from the older geological formations. The rock splits indefinitely in a direction which is generally uniform over a wide area, inclined at a high angle to the horizon, and altogether independent of the nearly obliterated original bedding of the rock. Under the microscope the component particles of the rock are seen not only to be rearranged with their long axes all in one direction, but also to be to some extent compressed, thus giving the "grain" to the rock. Slate differs in colour, being sometimes black, ferruginous, silvery, or green, but more often of a purplish-grey. It often contains scales of mica, minute crystals of garnet, or larger spots of chlorite, andalusite, kyanite, staurolite, or other minerals. The black slates may contain a considerable proportion of organic matter. Those containing garnets or other hard varieties are used as oilstones; but the chief use of the material is for roofing, for which the Bangor and other North Wales slates are the best in Britain. Several thousand tons are quarried annually, and over fifty million slates by tale are exported, chiefly to Europe. Immense numbers of small slates are used for writing purposes in schools.

Slaughterhouses are places set apart by municipal or other authority for the killing of cattle and other animals, with a view to avoiding the insanitary effects of having animals killed in all sorts of holes and corners amid human habitations, and to maintaining a better opportunity of inspecting the condition and quality of meat offered for consumption. Napoleon in 1818 established *abattoirs* at Paris, and Edinburgh followed the example in 1851, to be followed by London, which established a slaughterhouse at Islington in 1855. At the present time there are few towns of any pretension which do not possess these institutions. As a good example of them are the Lairages at Liverpool, where a cargo of beasts is quickly slaughtered, and the carcasses hung up in well-arranged and ventilated cooling-sheds. The foreign cattle market, Deptford is another example. The principal regulations for building and carrying on slaughterhouses are in the direction of cleanliness, health, and scientific operation.

Slavery. [BROWN, AMERICA, NEGROES, GREECE, RUSSIA, ETC., ETC.]

Slav Languages, a large group of languages which collectively form a main branch of the Aryan linguistic family, intermediate between the Lithuanian and Teutonic branches, but much more closely related to the former than to the latter. No trace remains of the primitive Slav tongue, whence the members of the group have diverged, and the oldest known form dates only from 800 A.D., when it was reduced to writing by Cyril and Methodius, apostles of the Slav peoples. Their version of the Bible, one MS. of which is dated 1056, gives this idiom a certain pre-eminence as the liturgical language of the Slav Christians; but

it is not the Slav mother-tongue, any more than the Gothic of Ulfilas is the mother-tongue of existing Teutonic languages. It is even uncertain in what region of the Slav world this particular dialect was current, although by most authorities it is localised in Bulgaria, and even called "Old Bulgarian" in contradistinction to the extremely corrupt "Modern Bulgarian" now spoken in that district. The other chief members of the family are *Great* and *Little Russian*, *Serbo-Croatian*, *Chekh*, *Polish*, and *Wendish* (*Lusatian*), whose domain and numbers coincide with those of the respective Slav nations, as tabulated in the following article, SLAV RACE (q.v.). In fact, the table there given is based far more on linguistic than on ethnical considerations, as must always be the case in classifications of mixed peoples. In general the Slav languages, always excepting Modern Bulgarian, are more conservative, that is, preserve more of the primitive Aryan formative elements than do their Teutonic, Celtic, and Italic congeners, but in this respect stand on a much lower level than Lithuanian. Thus the Slav declension is still highly synthetic, retaining many of the old case endings which have disappeared from the modern Germanic and Neo-Latin tongues. All three genders persist, as do also very full dual forms of the noun, pronoun, and verb, while the verb itself presents a rich array of personal endings, moods, participles, and tenses, some organic, some later developments, like the Romance future. The Slavonic languages are written with three different alphabets—the Cyrillic, adapted from the Greek with numerous additions by Cyril and Methodius, and generally retained by the Orthodox Slavs with some slight modifications; the *Glagolitic*, of unknown origin, confined to the Southern Slavs, and now little used; the *Roman*, in use amongst all the Uniates (Catholics), with numerous diacritical marks and uncouth combinations to express sounds peculiar to the several idioms. The efforts made to reform these somewhat rude graphic systems have hitherto been attended with little success.

Slav Race, a main division of the Aryan family, occupying nearly the whole of East and a large part of South-east and Central Europe, with two chief branches, six sub-branches, and several minor groups, as shown in the subjoined table:—

Slavs, 105,500,000	Eastern and South-eastern Slavs 85,000,000	Russians	{ Great Russians. Little Russians. White Russians.
		Bulgarians, 3,700,000.	
	Western Slavs 20,500,000	Serbs 8,500,000	{ Servians, Bosnians. Croatsians. Dalmatians. Montenegrins. Slovenes.
		{ Chekhs 7,000,000 Poles, 13,300,000. Wends (Lusatians), 130,000	{ Bohemians. Moravians. Slovaks.

The Great Russians form the bulk of the population both in European and in Asiatic Russia, to which latter region they have spread in recent times; the Little Russians are confined to South-West Russia (Ukrania) and parts of Austria-Hungary, where

they are known as Ruthenians; the White Russians are concentrated chiefly in the western provinces of Russia proper about the frontiers of Poland. The Bulgarians—originally Ugro-Finns, but assimilated to the Slavs in speech, and partly in type, since the 11th century—occupy the whole of Bulgaria and a large part of Rumelia, and have numerous settlements both in Servia and south-west Russia. The Serbs, with their numerous sub-groups, are the dominant people in all the north-western parts of the Balkan peninsula and conterminous provinces of Austria-Hungary. The Chekh or Czech domain comprises over half of Bohemia, the whole of Moravia, and parts of Hungary, especially in the north-west. Since the dismemberment of Poland the Poles are distributed between Russia (Poland proper), Austria (Galicia), and Prussia (Posen). The Wends or Sorbs are a remnant of the extinct Polabish Slavs of the Elbe basin, still surviving in Saxon and Prussian Lusatia.

Slav, present collective name of the family, is referred either to the word *Slava* ("glory"), or more probably to *Slovo* ("word," "speech"), as indicating a people of distinct or intelligible utterance. Later it became a term of contempt (*eselave*, *schiaivo*, *slave*) amongst the western peoples, owing to the large number of Slav prisoners enslaved during the long struggle for ascendancy between the Slavs and Teutons in Central Europe. The older collective names, *Spor* and *Antes*, both first mentioned by Procopius (6th century), are probably to be identified with the *Surpe* of Alfred [SERB], and the *Eneti*, *Heneti*, *Veneti*, a Sarmatian people of Cisalpine Gaul, whose name survives in the modern Venetia, Venice. The still earlier relations of the Slavs to the Scythians and Sarmatians of the Greek and Roman writers involve obscure ethnical problems which cannot here be discussed. It is no longer possible to determine the original seat of the Slav people; but, from whatever centre the dispersion took place, it is certain that during their migrations they have become largely intermingled with Finns, Tatars, Teutons, Celts, Thraco-Illyrians, and many other races, so that it is no longer possible to speak of a pure Slav physical type. The primitive stock was probably blonde (blue or grey eyes and light hair), like the Teutonic; but at present the most marked general feature is brachycephaly (round head), showing a profound divergence from the primitive dolichocephaly (long-shaped head) of the Aryan people, and a corresponding approach to the brachycephalic Mongol type. Other distinguishing features everywhere cropping out in the various groups are a somewhat swarthy complexion, short, straight, or slightly concave nose, small deep-set eyes, straight or wavy dark-brown hair, full beard and medium stature, although the Bosnian Serbs are amongst the tallest people in Europe. In general, the fair type may be said to prevail amongst the Poles. Wends, Great and White Russians, the brown amongst the Serbs and Little Russians, while the Chekhs present an almost equal mixture of both. In the moral order the Slavs seem to hold a somewhat intermediate position between the Teutonic and Latin peoples: far less phlegmatic

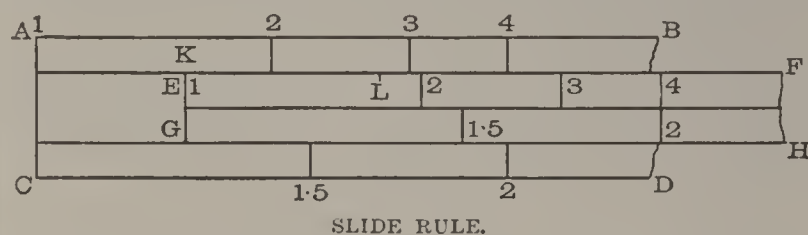
than the Germans, while nearly as quick and vivacious as the Italians and French. Hence the remark often made that the Slavs are southerners who have strayed eastwards; hence also perhaps the more than passing sympathy entertained by the Russians for the French despite wars and political rivalries. Within the several branches the national sentiment is strongly developed, as shown especially by the historic records of the Chekhs, Poles, and Serbs. But the idea of a "Pan-Slav Empire" is visionary because of the deep-rooted religious and political antagonisms, strengthened by linguistic differences, as between Roman Catholic Poles and Chekhs and Orthodox Russians, or between Ruthenian Uniates and Bosnian Mohammedans, all doubtless of Slav speech, but speaking mutually unintelligible dialects of the primitive Slavonic language.

Sleep, in plants, the assumption by leaves, especially the leaflets of compound leaves, of the nocturnal position, which is generally a folding in a vertical plane, under the influence of darkness or excessive illumination. The movements exhibited are identical with those induced in some of the cases, such as the sensitive plant, by contact, and with those which occur spontaneously, in spite of the inhibitory action of light, in others, such as the telegraph plant. "Sleep" movements only occur between 15° and 50° C. Prolonged darkness destroys the power; but for a time the leaves of the sensitive plant (q.v.), in the dark, exhibit spontaneous alternating movement, like those of the telegraph plant. Sudden variations in the intensity of light induce "sleep." The mechanism of the movements consists, as in the sensitive plant (q.v.), in the action of the pulvini.

Slickenside, a mining term originally applied to a smooth lustrous surface of specular galena (q.v.) in veins in the Carboniferous Limestone of Derbyshire; but now used for any rock-surface that is smoothed by friction against another, as is often the case in a fault (q.v.).

Slide Rule is a mechanical contrivance for performing the operations of multiplication and division. It consists of a graduated rule, A B C D, having a dovetailed groove in which a second rule, E F G H, can slide, the faces of the two being flush at the upper side. The corresponding scales on the rule and slide are identical, and are such that the distance from the mark 1 to the mark 2 is proportional to the logarithm of 2 [LOGARITHMS], the distance from 1 to 3 to logarithm 3, and so on up to 10; and the spaces between these marks are further subdivided logarithmically, the fineness of the dividing depending upon the length of the rule. Confining our attention for the moment to the scales A B and E F only, suppose that the mark 1 on E F is made to correspond with some mark on A B—say that corresponding to logarithm 1,545, which is at K. Now take any mark on E F—say L, which corresponds to 174; it is clear that the distance from A to L corresponds with logarithm 1,545 and logarithm 174, and the point on A B which is now opposite L will be marked with the number whose logarithm is logarithm 1,545 + logarithm 174—that is, with the product of 1,545 and

174, for the sum of the logarithms of two numbers is the logarithm of their product. We can perform division by reversing this process; if we set a number on E F opposite a number on A B, the distance from A to mark 1 on the slide will be the difference between the logarithms of the two



numbers, and mark 1 on the slide will be opposite their quotient. If we have a small brass slide with a mark on it (called a cursor) which fits over the rule, we can set its mark opposite the result of one operation, and use that point as the basis of further multiplication or division without actually reading the number, and in this way complicated calculations may be made without any use of paper or pencil. It is usual to duplicate the divisions on A B and E F—i.e. make the length from A to the end of the rule correspond to logarithm 100, and to graduate the lower half of both rule and slide (G H and C D) in such a way that the distance from A or E to any number is one-half the distance from G or C to the same number. As the logarithm of the square root of a number is half the logarithm of the number, it is evident that the root of a number is to be found on C D opposite the number on A B, and that squares may be found in the converse manner. Special marks are also made to correspond with constants which are often needed (such as π) and considerably facilitate many calculations. No account is taken on a slide rule of the index of the logarithm, so that the position of the decimal point must be determined by inspection of the numbers. Slide rules of circular or spiral form are sometimes used, but the one above described is the most common form.

Sligo, a county in the province of Connaught, Ireland, and its capital. The former is bounded N. by the Atlantic, W. by Mayo, S. by Roscommon, and E. by Leitrim, having an area of 721 square miles. The coast is deeply indented by the bays of Sligo, Donegal, and Killala, and the surface, low and swampy towards the sea, rises to the Slieve Gamph and Ox Mountains, over 2,000 feet in height. In this upper district are many loughs. The Arrow, Moy, Owenmore, and Garvogue are navigable rivers, and fish abound in all the streams and on the coast. The town of Sligo stands on the Garvogue river, and possesses a fairly good harbour. A considerable export trade is done in agricultural produce, flax, and linen, and there are flourishing flour-mills, saw-mills, breweries, etc. The only other towns in the county are Dromore and Tobercurry.

Sling, a kind of hanging loop in which a wounded limb is supported. The arm is the member for which the sling is most frequently employed.

Slipper-Animalcule or PARAMÆCIUM, a genus of Infusoria very abundant in fresh or salt

water containing much decomposing vegetable material. The animal is of much value, as the action of the contractile vesicles (q.v.) and the stellate form taken by them during contraction can be easily studied in it. *P. aurelia* is the commonest species: it is usually a little less than one-hundredth of an inch in length.

Sloane, SIR HANS, BART., was born in 1660, and, settling in London, soon attained high professional and scientific repute. He was the first medical man who ever won hereditary honours, receiving a baronetcy from George I. on his accession in 1714. Successively Physician-General to the army and to the king, President of the Royal College of Physicians, and the Royal Society, he amassed a large private fortune, much of which was devoted to the collections that formed the nucleus of the British Museum. Botany was his favourite study, and in pursuit of it he made two voyages to the West Indies. He died in 1752.

Sloe (*Prunus spinosa*), also known as BLACK-THORN, with dark-grey bark, spinous branches, precocious white flowers, elliptical leaves, and globose, dark-purple, glaucous drupes. The shoots make excellent walking-sticks: the leaves are said to be used to adulterate tea; and the fruits, which are sour and rough in taste, are eaten by children, preserved, and used to flavour spirits. The shrub is the badge of the M'Quarrie clan.

Slojd ("SLEIGHT") is an institution which originated in Finland and Sweden, and consisted in teaching handicrafts in schools, so as to educate the hand and eye of a pupil as well as his intellect. He begins by making small objects of use or ornament, passing on, as he gains in power, to more elaborate and useful work. A similar idea lies at the root of the Kindergarten system and the rapidly-developing practice of giving technical education.

Sloke. [LAVER.]

Sloth, any individual of the Edentate family Bradypodidæ, with two genera (*Bradypus* and *Choloepus*) from Central and South America. In the first genus, to the species of which the name "Ai" is often applied from their cry, there are but two functional digits on the fore-limbs; in the second there are three. They are vegetable feeders and arboreal in habit, and move along the branches of trees, with the body downwards. The body is covered with long, coarse hair, which is often covered with a growth of green algæ. The largest of the family is about 30 inches long.

Sloth Bear (*Melursus labiatus*), an Indian bear, from five feet to six feet long, with black fur, and a light V-shaped mark on the breast. It feeds on fruit, birds' eggs, and insects.

Slovaks, a Slav people of North-West Hungary, numerous especially in the Waag and Gran valleys and about the head-waters of the Taracz and Tapoli affluents of the Theiss, with scattered groups in the Buda-Pest district and in other parts of Hungary as well as in Moravia. Slovak, which is a distinct dialect of Chekh (Bohemian), is spoken altogether by about 2,000,000 people. The physical type is

distinguished by very round and low head, stature below the average, and a large percentage of blondes (fair hair, blue or grey eyes) due probably to German intermixture. The Slovaks are two-thirds Roman Catholic and one-third Protestant.

Slovenes (SLOVENCI, SLOVINTZY), a Slav people of the Austrian provinces of Istria and Carniola and the districts bordering on Styria and Carinthia; speak a Serbo-Croatian dialect and number (1890) 1,180,000 (showing an increase of 36,000 since the previous census of 1880), now mostly Roman Catholics. Like the kindred Croats, the Slovenes are physically a fine race, tall, well-made, generally with dark-brown hair and moderately round head. Though now yielding to Serbo-Croatian, the Slovene language has been long cultivated, and has had two literary periods: a Protestant in the 16th century, followed in the 17th and 18th by a Catholic reaction, when most of the works of the early reformers were burnt by the Jesuits.

Slow-Match is used in blasting to enable the workmen to retreat to a safe distance before the ignition of the explosive, and for the firing of shells, etc. It consists of some material the burning of a given length of which will occupy a fairly definite time. A fibrous wick, soaked in a solution of nitre and dried, is one of the oldest devices, but a tube filled with a composition similar to that used in the manufacture of fireworks is often employed.

Smallpox. Variola. An infectious disease, the chief symptoms of which are fever and a characteristic eruption, at first papular, then vesicular, and ultimately pustular. The malady appears to have prevailed in Europe in the early centuries of the Christian era, and it was recognised and described by the Arabian physicians. It is known to have caused considerable ravages in various parts of the world during succeeding ages, and until the end of the last century was regarded as one of the most serious of epidemic diseases. The introduction of inoculation into this country in the 18th century seems to have, in some degree, diminished the amount of injury wrought by smallpox, and with the growth of the practice of vaccination (q.v.) introduced by Jenner at the end of the last century, the prevalence of the disease has markedly declined. Cases of smallpox are now rarely met with, and it is difficult to realise how widespread and potent for mischief the disease formerly was.

Symptoms. The period of incubation of smallpox is usually about 12 days. On or about the 13th day after the exposure of a susceptible person to infection, a rise of temperature occurs, with shivering, aching of the limbs, vomiting, headache, and intense pain in the back; on the third day counting from the commencement of the initial symptoms, the rash develops in the form of minute reddened papules, which appear first on the face, neck, and wrists, and later become generally distributed over the body. The spots have at the outset a hard "shotty" feeling when touched; they increase in size, and in the course of about three days they have developed into vesicles, and in three days more into pustules. Sometimes the pustules are quite

distinct from one another (discrete smallpox); sometimes they run into one another (confluent smallpox). The pustules when fully developed usually present a central depression, what is called the umbilicated appearance. The temperature, which at the outset may attain a considerable degree of elevation, usually falls when the eruption first appears, and again rises (secondary fever) when the pustules become formed. After a few days in cases which do well the fever again subsides, the pustules dry up, and convalescence supervenes. In the severer forms of the malady extensive scarring of the skin occurs, in the milder forms there is only slight pitting, and in the mildest no traces of the disease are left behind. The chief sequelæ of smallpox are ophthalmia, otitis, laryngitis, and lung troubles. The severity of the disease bears a distinct relation to the extent of development of the eruption. Discrete smallpox is rarely fatal, while in confluent smallpox nearly half of those attacked die. Malignant smallpox is the variety of the disease in which the early symptoms are especially severe, in which hæmorrhages beneath the skin and conjunctivæ occur, and in which a fatal issue supervenes usually before the eruption has had time to become developed. The desirability of isolating smallpox patients in hospital, as soon as the nature of the malady becomes apparent, cannot be too strongly insisted upon, and any persons who have been brought into contact with the infected individual should at once seek advice as to the desirability of being revaccinated.

Smaltite, an arsenide of cobalt, occurring in isometric crystals of a tin-white colour; it frequently contains nickel and iron.

Smart, CHRISTOPHER, b. 1722, was educated at Durham and Pembroke Hall, Cambridge, where he got a fellowship in spite of some youthful irregularities. He showed a talent for versification, won the Seaton Prize several times, and published translations of no great merit. He produced one poem that survives, *A Song to David*, and died in 1771.

Smart, JOHN, R.S.A., was born at Edinburgh in 1838, and received an artistic training at the Trustees School, whence he went to MacCulloch's studio. He began to exhibit landscapes in 1861, and was elected an Associate of the Scotch Academy in 1871, reaching the full dignity six years later. Among his best works are *Where Silence Reigns*, *The Graves of our ain Folk*, *The Land of MacGregor*, *The Cradle of Argyll*, *Among the Silent Hills*, *The Pass of Brander*, and *The Golf Greens of Scotland*.

Smeaton, JOHN, was born in 1724. In 1750 he had set up in business as a maker of mathematical instruments, and he soon began to send papers on scientific subjects to the Royal Society, winning the gold medal in 1759. He had gradually been drawn towards hydraulic engineering, and, when the Eddystone lighthouse was burned down in 1755, was consulted as to its rebuilding. In 1759 he completed the stone structure, which was used until 1879, when the rock beneath it was declared unsafe. Smeaton now obtained an

enormous practice as an engineer, especially in the building of bridges, but he did not neglect mechanics, and brought the atmospheric steam-engine to high perfection. He died at Leeds, 1792.

Smelt (*Osmerus eperlanus*), a British food-fish of the Salmon family, of trout-like form, with projecting lower jaw. It is fairly common round our coasts and those of Europe and America, and often ascends rivers, and in some places is acclimatised in fresh-water. The average length is from eight to ten inches; the general colour is whitish, with green tints on the back and blue on the sides.

Smelting, the process by which metals are separated from their ores. [IRON, BLAST-FURNACE.]

Smew. [MERGANSER.]

Smilax, a large and widely-distributed genus of tropical and sub-tropical climbing shrubs, the type of the sub-order Smilacæ of the order Lilacæ. They have generally fleshy rhizomes; prickly stems; cordate, irregularly net-veined glabrous leaves, with two stipular tendrils; small, polygamous flowers in globular clusters; and small baccate fruits. Sarsaparilla (q.v.) is obtained from the rhizomes of various species in different parts of the world. Several species are grown for ornament.

Smiles, SAMUEL, LL.D., was born in 1812, and educated for the medical profession, which he abandoned for journalism, becoming editor of the *Leeds Times*. In 1845 he was appointed secretary of the Leeds and Thirsk Railway, passing ten years later to the same post on the South-Eastern, and resigning it in 1866 to devote himself to literature. In 1857 he had brought out his well-known *Life of George Stephenson*, to be followed by *Self-Help* (1859), *Lives of the Engineers* (1861), *Industrial Biography* (1863), and *Lives of Boulton and Watt* (1865). The fruits of his later labours have appeared in two volumes on the Huguenots in England and in France, *Character, Thrift, Duty, Life and Labour*, with other works. In 1878 he received the degree of LL.D. from Edinburgh University.

Smith, ADAM, was born in 1723. He passed from the University of Glasgow to Baliol College, Oxford, where he spent seven years. Returning to Scotland, he made the acquaintance of Lord Kames and David Hume, through whom he got in 1751 the professorship of logic, and afterwards that of moral philosophy at Glasgow. His lectures were thoughtful yet popular, and they are summed up in his *Theory of Moral Sentiments*. In 1763 he accompanied the young Duke of Buccleuch on a foreign tour, and made the acquaintance of Helvetius, Turgot, Marmontel, D'Alembert, and Quesnay, from the last of whom he is said to have imbibed certain economical doctrines. From 1766 to 1776 he remained with his mother at Kirkcaldy, engaged on his great work, *An Inquiry into the Nature and Causes of the Wealth of Nations*, the foundations of which were laid during his professorial career. It is scarcely possible to overrate the influence this treatise has exercised on the world, though its effects were not felt immediately. It established the law of supply and demand, made labour, not

land or precious metals, the source of wealth, and paved the way for Free Trade. Smith for a couple of years lived in the best intellectual society of London, but in 1778 went back home as commissioner of Customs at Edinburgh. The rectorship of Glasgow University was conferred on him in 1787 to his great delight, and in 1790 he succumbed to a long and painful malady.

Smith, ALEXANDER, born in 1830, followed at first his father's trade of pattern-designer in a linen factory. However, his strong literary tendencies found expression in fugitive verses contributed to the *Glasgow Citizen*, and under the patronage of Gilfillan he got permanent work. In 1853 appeared *A Life Drama and other Poems*, which made its author famous for a time as the chief exponent of "The Spasmodic School," and won him the post of secretary to the University of Edinburgh. In 1855 he published *War Sonnets*, in conjunction with another rhapsodist, Sydney Dobell, and *City Poems* (1857), with *Edwin of Deira* (1861), added somewhat to his reputation. He next turned his hand to prose, writing *Dreamthorpe*, *A Summer in Skye*, and *Alfred Hagart's Household*, none of which were completely successful. His health, never very strong, broke down in 1866, and he died early in the following year.

Smith, GOLDWIN, was born in 1823, and, coming up to Oxford from Eton, carried off all the chief University prizes, and was elected to a fellowship at University College, and afterwards to a honorary fellowship at Oriel. He acted as secretary to both University Commissions, and to that on Popular Education. In 1858 he was made Regius Professor of Modern History, holding the chair until 1866. During the War of Secession in America he stood forth as a fervent Abolitionist, and at the end of the struggle went on a lecturing tour through the States, writing, on his return, two books dealing with the political relations of England and America. In 1868 he accepted a professorship of history in Cornell University, New York, but three years later settled at Toronto, Canada, took an active interest in the Toronto University, and edited several papers.

Smith, HORACE and JAMES, were born respectively in 1780 and 1775, being the sons of a prosperous London solicitor. In 1812 a prize was offered for a poem, to be recited at the opening of the New Drury Lane Theatre, and the Smiths conceived the happy idea of writing parodies of the styles of all contemporary poets, and publishing them in a volume entitled *Rejected Addresses*. James took Wordsworth, Southey, Coleridge, and Crabbe, whilst Byron, Moore, Scott, and Bowles fell to the share of Horace. The venture proved an immense success, and was so gracefully undertaken as to hurt nobody's feelings. James never made any subsequent attempt to add to his fame. He died in 1839. Horace earned a fortune on the Stock Exchange, and then essayed to fill Scott's place as historical novelist. Out of a score of his romances *Brambletye House* alone survives. He died 1849.

Smith, THE REV. SYDNEY, was born in 1771, became captain of Winchester, and entering at

New College, Oxford, obtained a fellowship and drifted into the Church. After holding a curacy on Salisbury Plain, he went to Edinburgh as a private tutor, there met Jeffrey, and joined him, Brougham, and other advanced Whigs in founding the *Edinburgh Review*, the first issue of which he edited in 1802. He had now established his reputation as a thinker of independent views, a brilliant writer, and above all, a wit of the keenest, yet most genial, order. He came to London, married happily, figured for a while as a social lion and a popular preacher and lecturer, and then took the living of Foston-le-Clay, in a desolate part of Yorkshire. He had, in the meanwhile, published anonymously *Peter Plymley's Letters*, which did much to pave the way for Catholic Emancipation. In 1828, Lord Lyndhurst, though a Tory, gave him a canonry at Bristol and a living at Combe Florey, near Taunton, but it was not until 1831 that his party got into power, and then he received a prebendal stall at St. Paul's. The premature death of his eldest son was a cruel blow, but the marriage of his daughter with Lord Holland added much to the happiness of his later years. He died in 1845.

Smith, SIR WILLIAM, LL.D., D.C.L., was born in 1813, and took high classical honours at the University of London. Whilst reading for the Bar he engaged in literary work for the publishing house of John Murray, and in 1840 began the compilation of the *Dictionary of Greek and Roman Antiquities*, which was followed by the series of encyclopædic books of reference with which his name will long be associated. He found time, moreover, to act as classical examiner and member of the Senate of the London University, to prepare an edition of Gibbon, and to supervise the great *Atlas of Biblical and Classical Geography*, which appeared in 1875. He became editor of the *Quarterly Review* in 1867, and maintained the high literary and intellectual traditions of that periodical until his death in the autumn of 1893.

Smith, WILLIAM HENRY, was born in 1825, and educated at Tavistock grammar school. In 1865 he turned his attention to politics, ousted John Stuart Mill from the representation of Westminster, and held the seat continuously until his death. A man of prodigious industry and unimpeachable integrity, he soon made himself of use to the Conservative party, and held office from 1874 to 1889 as Financial Secretary of the Treasury and First Lord of the Admiralty. On the return of his party to power in 1885 he went to the War Office, and subsequently, for a few days, to the Irish Office. When Lord Salisbury formed his second Cabinet, Mr. Smith resumed his old post, which he exchanged soon after for that of First Lord of the Treasury and Leader of the House. In 1891 his constitution broke down, and he died after a brief illness.

Smith, SIR WILLIAM SIDNEY, was born in 1764, entered the navy as a child, and for his courage in Rodney's action off Cape St. Vincent got his lieutenancy in 1780, becoming a captain after many gallant services at the age of eighteen. From 1790 to 1792 he was naval adviser to the King of Sweden, and received knighthood. Sent on a mission to

Constantinople, he joined Lord Hood off Toulon and helped to burn the French fleet. In 1796 he was taken prisoner whilst operating against privateers in the Channel, passed two years in prison, and made his romantic escape from the Temple. Next year he forced Napoleon to raise the siege of Acre, and was wounded at Aboukir, where he served as a brigadier under Abercromby. Returning to England, he received many honours and rewards, and was elected M.P. for Rochester. In 1814 his career practically came to an end, and he settled among his old enemies in Paris, where he died in 1840.

Smithfield, WEST. Until 1855 Smithfield, originally a suburban district just N. of London, was the chief mart for live and dead cattle, the trade amounting to seven millions a year. At that date the New Cattle Market was opened in Copenhagen Fields, and the great depôts for provisions of all sorts were established a little later on part of the site of Old Smithfield. **EAST SMITHFIELD** is a district between Tower Hill and Ratcliff Highway. It was comparatively rural until the middle of the 17th century, for Charles I. killed a stag here in 1629, but is now densely crowded with poor streets.

Smithsonian Institution is a scientific foundation established at Washington, United States of America, in 1846. The history of its origin is this:—James Smithson, son of a Duke of Northumberland, graduate of Oxford, where he was distinguished for his attainments in chemistry, became in 1790 F.R.S., and associated with the men of scientific note of the day. After a life of travel, he died at Genoa, and left a large property to his nephew, with reversion, in default of direct heirs, to the United States, for scientific purposes. Thus, in 1838, the United States Treasury inherited 515,169 dols., and the interest on this enabled them to start the Institution on a liberal scale. The interest only of the fortune is employed, and with this research is endowed and scientific publications are issued. The buildings are fine, and contain the national museum and a good library as well as the Library of Congress.

Smoke is usually a gaseous current conveying solid particles in a fine state of division. If a piece of zinc be heated strongly in the air, it will catch fire and burn with a brilliant bluish flame, evolving dense clouds of white smoke. This smoke is of the simplest kind. It consists of zinc oxide—often known as zinc white—which is carried upwards by the heated air. The smoke from burning fuel is of a more complex nature, although carbon in the form of soot is often present in large quantities. This is accompanied by carbon dioxide, oxygen, nitrogen, and, sometimes, carbon monoxide. In large towns the escape of large quantities of smoke into the atmosphere is considered as a nuisance, and is punishable by fine. Such an escape of smoke shows, however, that the fuel is not being consumed economically, so that it is to the consumer's interest to prevent it. To this end large furnaces are supplied with arrangements for regulating both the supply of fuel and of air to the fire-place.

Smolensk, or **SMOLENSKO**, a government of Central Russia, lying W. of Moscow, and having an area of about 22,000 square miles. Watered by the Dnieper, Dvina, Gshat, Oka, and other rivers, its soil is very fertile, and yields heavy crops of cereals, hemp, flax, hops, and tobacco. The capital, a fortified town on the Dnieper, 250 miles S.W. of Moscow, possesses the usual administrative institutions, three cathedrals, many churches and monasteries, and is the seat of an archbishopric.

Smollett, **TOBIAS GEORGE**, the younger grandson of a Scotch legal laird, was born at Dalquhurn, Dumbartonshire, in 1721, and brought up, amidst some hardships, for the medical profession. His grandfather, dying, left him penniless at the age of eighteen, and he came up to London with his tragedy *The Regicide*, but took the post of surgeon's mate in the navy, serving until 1746, when he resolved to seek a livelihood in literature. His first ventures, *Advice* and *Reproof*, two satirical poems, found a publisher, but his plays were rejected, and he and his wife, a dowerless West Indian girl, were reduced to cruel straits. Under these circumstances he wrote *Roderick Random*, which appeared in 1748, and at once brought its author into note, being full of the rollicking, somewhat cynical, humour then in vogue through Fielding's masterpieces. *Peregrine Pickle* followed three years later, and proved an equal success, though inferior as a literary production. *Ferdinand, Count Fathom*, a repulsive but more cleverly-constructed story, was published in 1753, and then for a time Smollett contented himself with hack-work, such as his translation of *Don Quixote*, his *Compendium of Voyages, History of England*, and *Present State of All Nations*. He engaged, too, in political controversy on the Tory side, and produced *The Rapiers*, a farce intended to stimulate hostility towards France. His health now broke down just as he had returned to romance in *Sir Lancelot Greaves*, and in 1763 he went abroad, coming back to publish his travels in 1766. *The Adventures of an Atom*, inspired by disappointed hopes, was produced in 1769, when his state compelled him to seek a change at Monte Novo, near Leghorn. Here in his sick room he composed *Humphrey Clinker*, in many respects his most attractive novel, and here he died in October, 1771.

Smuggling denotes (1) the importation or exportation of prohibited goods, and (2) the defrauding the revenue by avoiding a duty levied upon the production or consumption of an article. In its ordinary use, the word is applied only to the former of these, and in these days of Free Trade the custom of smuggling has well-nigh died out, since the profit does not pay the risk. For smuggling the penalty is treble the value of the goods smuggled and a possible fine of £100. Any preventive or excise officer may go on board a ship and search it, and may search any waggon, cart, or other vehicle, and has also the right to search any person aboard of or leaving a ship, and any person obstructing him is liable to a fine of £100. An armed combination of persons for smuggling purposes constitutes a felony. The southern sea-board of England, half a

century ago, abounded in tales of smugglers, their haunts, their devices, and their occasional pitched battles with the preventive men. Tobacco and spirits are generally the objects now smuggled.

Smut (*Ustilago Carbo*), a phycomycetous fungus, parasitic upon grasses, especially oats and other cereals. Its mycelium permeates the seeds and other reproductive organs of the host, forming black spores, which germinate when the seed falls, producing a pro-mycelium with sporidia. These latter, in turn, produce a new mycelium, which penetrates young plants. The allied fungus *Tilletia Caries* produces the similar disease in wheat known as *bunt*.

Smyrna (Turkish *Ismir*), a seaport of Anatolia, Asiatic Turkey, situated at the head of the Gulf of Smyrna, on the coast of Asia Minor, 212 miles S.W. of Constantinople. It is divided into four quarters, in which Turks, Armenians, Jews, and Franks dwell apart. The harbour is excellent. There are large and well-stocked bazaars, a palace for the Governor, many mosques and churches, an English hospital, and some few remains of ancient structures. The principal exports are Turkey carpets, fabrics of silk and Angora goat's hair, sponges, dried fruits, drugs, gums, coffee, and a few precious stones. A railway has been constructed as far as Aidin, 70 miles inland.

Snail is the name of one of the best known members of the Gastropoda (q.v.), one of the classes of the Mollusca. The snails are well known, as they are widely distributed, and usually very abundant, and as they live on land. The name is often used in a general sense for all the molluscs with a shell (composed of a single shell) which live on land; it is, however, more correctly restricted to



COMMON SNAIL (*Helix aspersa*).

those belonging to the genus *Helix*. The "Water-snails" include species belonging to the genera *Planorbis*, *Lymnaea*, *Paludina*, etc. The snails have a coiled, spiral shell, which is often prettily ornamented by colour bands; they live on trees, grass, and under stones, etc., and are especially abundant in limestone districts. The animals feed on vegetable material, which they cut up by means of a long-toothed ribbon, or saw-like tongue, known as the "radula." They are active during the summer, and hibernate in winter, when the mouth of the shell is closed by a thin gelatinous film known as the "epiphragm." The animals are hermaphrodite, but always pair with other snails, and self-fertilisation never occurs. The snail is a very useful type in biology. The largest living species in England is *Helix pomatia*, the edible or Roman snail.

Snakes. [SHOSHONEANS.]

Snakes (*Ophidia*), an order of Reptiles (q.v.), the members of which are well known from their generally long, lithe bodies, their gliding motion, the absence of external limbs, and the terrible power possessed by many of them of inflicting deadly wounds by means of their poisonous fangs. In some of these points they resemble other animals: in shape some are not to be distinguished from limbless lizards—often confounded with snakes—and limbless fish; while poison-fangs are possessed by at least one lizard, the Heloderm (q.v.) The skin is covered with scales, and is shed periodically; sometimes, as in the case of the Common British Snake (*Tropidonotus natrix*), several times in the year. There are no external ear-openings, and the nostrils are near the extremity of the head. Eyelids are absent, but the transparent skin covers and protects the eyes. Most of them possess scent-glands near the vent, and when irritated they pour forth the ill-smelling secretion very freely. The vertebræ, hollow in front (procœlous), are very numerous, and the ribs function as limbs, by means of which these creatures row their way along on any surface not absolutely smooth. The skeleton of the head is remarkable for the mobility of the bones of the lower jaw, which can be entirely separated from the base of the skull proper, thus enlarging the capacity of the mouth and throat. It is owing to this arrangement, and to the elasticity of the skin, that snakes can swallow prey so much bigger round than themselves. In some snakes, the Boas, for example, there are traces of a rudimentary pelvis and of equally rudimentary hind legs. The tongue, which is cleft at the tip, can be drawn back, and moved freely in any direction, and serves as an organ of touch; but no snake uses it, as the Boas were said to do, to lubricate the prey with saliva before swallowing it. The poison-gland is a specialised salivary gland; and the poison-fangs, borne on the upper jaw, are furnished with a canal or a groove down which the poison flows into the wound when a venomous serpent strikes. Most snakes are oviparous; some few are viviparous, and the pythons incubate. One case has occurred in the Zoological Gardens, Regent's Park, and another was reported from Leipsic in 1893. Snakes are widely distributed, but attain their greatest development of size and numbers in tropical countries, where, as might be expected, the most venomous forms are found; and in India the deaths from snake-bite are extremely numerous. Many so-called specifics have been recommended; but the treatment which Sir Joseph Fayrer (*Thanatophidia of India*) recommends is the application of a ligature above the bite, scarification or cautery of the wound, and keeping up the patient's strength. In Britain there are three representatives of the order, the Ring Snake and the Viper (both of which see), and the Smooth Snake (*Coronella lævis*), confined to the south of England. In habit snakes are mostly terrestrial, some are arboreal, and a few are marine. [SEA-SNAKES.] Most of them prey on mammals, birds, and reptiles, and amphibians, and some on molluscs and insects, while most are fond of milk, and one South African snake (*Rachiodon*) subsists

on eggs, which are broken by the so-called gular teeth—really the inferior spines of the anterior vertebræ. The contents flow down the throat, and the shell is rejected. The following classification of the order is that generally in use:—

BLIND SNAKES (*Typhlopidae*), the lowest of the order, small burrowing forms that feed on worms and insects. They are found in tropical countries and Australia. There is one European species.

HARMLESS COLUBRIFORM SNAKES (*Colubri-formes*). These are harmless to man, but some of them have the teeth grooved, showing intimate connection with the next group. Here belong the Boas, Pythons, Tree-Snakes, and our British snakes.

COLUBRIFORM VENOMOUS SNAKES (*Colubri-formes venenosi*), as the Cobras, Hamadryas (snake-eating snake), Coral-Snakes, and Sea-Snakes, with erect grooved teeth and poison glands.

VIPERIFORM SNAKES (*Viperiformes*), with erectile, perforated teeth, and poison-glands, as the Vipers, Rattlesnakes, etc.

But, as the poison of snakes is a question of degree rather than of kind, the old division into Harmless and Venomous Snakes will probably lapse in favour of the classification introduced by Mr. Boulanger in his *Catalogue of Snakes in the British Museum (Natural History)*, vol. i., where characters of the skull are taken as the basis of grouping. He recognises the following families:—*Typhlopidae*, *Glaconiidæ*, *Boidæ*, *Ilysiidæ*, *Uropeltidæ*, *Xenopeltidæ*, *Colubridæ*, *Amblycephalidæ*, and *Viperidæ*.

Snake, or LEWIS, RIVER, rises in the Rocky Mountains, on the borders of Wyoming and Idaho, U.S.A., and, after a semicircular bend to the S.W., turns due N. and, forming the boundary between Idaho and Oregon, joins the Columbia. It has a length of 900 miles, and is broken in its upper course by many falls. The Owyhee, Big Wood, Salmon, and Kooskoosky are among its affluents.

Snake Stones, a term used (1) for charred bones or pieces of porous stones which, when laid on a snake-bite, were said to absorb the poison; (2) for ammonites (q.v.), from the fact that fraudulent dealers fitted fictitious heads to them and sold them as fossil snakes; and (3) for adder-heads (q.v.).

Snapdragon, the popular name for *Antirrhinum majus* and allied species, scrophulariaceous plants with racemes of showy flowers, with a saccate "personate," i.e. mask-like, corolla, followed by oblique, two-chambered, many-seeded pore-capsules. The flower differs from that of the toad-flaxes in having a pouch instead of a spur. *Antirrhinums* are old-fashioned garden favourites.

Sneezing. The act of sneezing consists in a preliminary taking in of air, which is then expelled by spasmodic contraction of the expiratory muscles, all way of escape through the mouth being blocked by contraction of the muscles of the fauces and the descent of the soft palate, and the current of air being in consequence made to pass through the nose.

Snider, JACOB, born in 1820, started in business as a wine merchant, but failed. He then devoted himself to mechanical inventions, and in

1859 came over to Europe with a model of the Mount Storm breech-loader, made by converting the muzzle-loading rifle of the United States army. His modified plans were at last accepted by the English War Office for the conversion of the Enfield rifle, and the new weapon was known by the inventor's name. Endless disputes then followed as to his remuneration, till, crushed by poverty and disappointment, he died in 1866 before he got his claims recognised.

Snipe, any bird of the genus *Gallinago* of the Wading family *Scolopacidæ*, with twenty-four species universally distributed. The bill is long, straight, slightly flexible, extremely sensitive, and serves as a delicate organ of touch by means of which these birds procure the worms and insects on which they feed, and which they obtain by thrusting the bill into the mud and soft earth of the marshy and fenny places they frequent. Three species are British. The Common Snipe (*G. caelestis*) spends the summer and breeds here, leaving in autumn and returning in the spring. The total length is about eleven inches. The general plumage is shades of brown and buff marked and barred with black; the belly is white. The Jack Snipe (*G. gallinula*), a much smaller species, is a winter visitor. The Great, Solitary, or Woodcock Snipe (*G. major*) visits this country in the autumn in its southward migration. These birds afford excellent sport, and are all highly valued for the table.

Snow, the crystalline form of atmospheric moisture formed when the temperature is below the freezing-point. Snow falls in flakes, each of which consists of a number of symmetrically six-rayed, star-like crystals, sometimes exceedingly complex in form. More than a thousand forms have been described. The opaque whiteness of snow, like that of table-salt, results from the numerous reflections from the faces of the minute crystals, which individually are transparent. Snowflakes contain about nine times as many volumes of air, entangled, so to speak, among their crystals, as they contain water; so that a fall of snow ten inches deep is about equivalent to an inch of rain. Snow is a bad conductor of heat, so that when on the ground it protects plants from frost. Snow never falls at the sea-level within the tropics, and seldom in the southern hemisphere north of 48° S. The *snow-limit* for sea-level passes through Buenos Ayres, Cape Town, Melbourne, and Sydney in the southern, and through Mexico, North Africa, Asia Minor, the south of the Caspian, the north of Hindostan, and Canton, in the northern hemisphere. In England, whilst it descends to sea-level in winter, it rises in summer several miles overhead, the fleecy cirrus-clouds then seen being composed of snow. Considerably higher than the isotherm of 32° is the *snow-line*, or line of perpetual snow, above which the snow never entirely melts. At Quito, near the equator, it is at 15,800 feet; in Mexico (19° N.) at 14,800; on the south side of the Himalayas, which is supplied with abundant moisture from the Indian Ocean, it is at 16,200 feet; but on the north side, which is heated by the dry air from Thibet, at 17,400. In Granada (37° N.)

it is at 11,200 feet, and on Mont Blanc (46° N.) 8,500 feet. Though there is generally some snow on Ben Nevis, no point in the British Isles actually reaches the snow-line. In Iceland (60° N.) it is at 3,100 feet; at the North Cape 2,000 feet, and at Spitzbergen at sea-level. Besides the protection of vegetation, the chief geological actions of snow are the formation of avalanches (q.v.), glaciers (q.v.), and summer floods, such as those of Mesopotamia.

Snowberry (*Symphoricarpos racemosus*), a North American shrub, belonging to the honeysuckle order, commonly grown in English gardens, with roundish smooth blue-green leaves; small pink flowers and large globular dead-white berries, which are four-chambered but have two chambers aborted, the other two each containing one seed. The cells of the pulp of the fruit are exceptionally large.

Snow-Bird (*Fringilla hiemalis*), a North American finch, quite as familiar a bird in the States as the robin is with us. Its length is about six inches; the plumage is slate-brown above, the lower parts and the two outer tail feathers white.

Snow Bunting (*Plectrophenax nivalis*), an arctic and sub-arctic finch, coming southwards in winter as far as Morocco. Large flocks occur in winter in the British Isles, and some have remained to breed in the north of Scotland and Shetland. The total length is a little more than six inches, and the plumage black-and-white above and white below. The coloration, however, varies considerably at different seasons, and on that account these birds have been described under more than one name. In winter they feed on seeds, and in summer on insects. Soon after their arrival in their winter quarters they become very fat, and are then esteemed a delicacy. The Greenlanders take them in great numbers, and dry them for future use. [BUNTING.]

Snowdrop (*Galanthus nivalis*), a beautiful British winter-flowering amaryllidaceous plant. It has a bulb, a pair of narrow linear glaucous leaves, and one or two drooping white flowers with a membranous two-nerved spathe, a spreading white calyx, and three erect notched petals, white with green points. In gardens it is often doubled, and several other species are also cultivated.

Snyders, FRANZ, was born at Antwerp in 1579, and studied painting under P. Breughel and H. van Balen, devoting himself chiefly to still-life, flowers, and animals. Probably no one ever succeeded better in catching the spirit of wild nature and in reproducing the colour and texture of fur and feather. He frequently co-operated with Rubens and Jordaens, and was court painter to the Archduke Albert, Governor of the Netherlands. He died at the age of seventy-eight.

Soap. Soap has been known for a considerable time; it is spoken of by Pliny and certain other classical writers, while a soap manufactory was discovered within the ruins of Pompeii, containing specimens of the substance which did not differ essentially from what we at present employ.

Although known for such a lengthy period of time, the improvements in the process of its manufacture have been but slight. All soaps consist of alkalies united with the acid present in various oils or fats. These latter compounds consist of an acid combined with glycerine, and in the process of soap-making this glycerine is replaced by soda or potash, so that the resulting soap is really merely the sodium (or potassium) salt of the organic fatty acid. The chief acids present in the fats are stearic, margaric, and, to a smaller extent, oleic acids, and it is the salts of these compounds which, in different proportions, constitute most soaps. For the manufacture the fat, such as tallow or palm oil, is placed in a large cauldron or boiler, the necessary amount of soda solution or lye is added, and the whole is kept boiling until the action is completed (from 1 to 2 hours). A quantity of salt is then added, which causes the soap to separate out and rise to the surface, as it is not soluble in salt solution. It is then ladled into wood or iron frames or moulds and allowed to set, after which it is cut into sticks by wire and placed in a drying-room to dry. Cakes, etc., and those used for toilet purposes, are made by pressure in moulds. For white soap or curd soap, tallow, palm-oil (which should be first bleached), or olive oil is usually employed, whilst the addition of lard improves the quality of the soap. In the yellow soaps resin is also added to the other ingredients, while marbled soaps or mottled soaps owe their appearance to the introduction of salts of iron. Toilet soaps do not differ essentially from the ordinary washing or curd soap, but are merely clarified and perfumed and coloured or marbled by mixing in small quantities of pigments or dyes. Soft soap contains potash in place of soda—*i.e.* a potassium salt of the organic acid—and is usually made from a “drying oil,” as hempseed oil, etc., instead of from tallow or palm oil. By lime and other salts soap is precipitated, as the lime salts of these organic acids are insoluble; owing to this hard water is not suitable for washing purposes, as the lime salts in the water combine with the soap acids, and no lather results until all have been thus got rid of. According to the great chemist Liebig, the quantity of soap used may be regarded as a measure of the civilisation of a country. Judged by this standard, England maintains its leading place, more being manufactured in this than in any other country, and the quantity used per head is equivalent to about 8.5 lbs. per annum, exclusive of that used in manufacturing operations.

Soap Bubbles. The outside of a liquid acts just as though it were an elastic skin stretched into a particular shape. If, therefore, we could get rid of the effect of the weight of a *drop* of liquid, we should see only the effect of this skin. When a very small drop is taken, we are approaching this state of things, and we notice that the drop is very nearly spherical, since the elastic skin pulls it till its surface is the smallest possible for the given quantity of liquid, and the sphere gives this minimum surface. A soap bubble shows this in a beautiful manner, for in this case we have

practically isolated the elastic skin itself. That the skin is exerting pressure upon the air inside it can be shown in the following way:—Blow a bubble at the end of a tube or pipe, and then remove the pipe from the mouth; the bubble immediately begins to force the air back again along the stem of the pipe, and out through the open end, while it subsides into a flat film. It is easily shown also that a small bubble exerts a greater pressure on the contained air than a larger one. If the interiors of two bubbles of different sizes be connected by a tube, the small one will grow smaller, while the larger one will increase, owing to the greater pressure of the smaller skin. The pressure, therefore, depends on the *curvature* of the bubble, and this is true whether the bubble be spherical or of any other shape, only that the value of the curvature is more readily realised in the case of a sphere than in that of a cylinder or other curved surface.

Two bubbles can be made to push each other about, but yet the actual films do not touch; there is a thin layer of air between the two, and this thin layer is present when one bubble is blown inside another, so that the two bubbles do not (if carefully blown) coalesce or burst. When they are merely externally resting against each other, the presence of an article electrified to the slightest degree will cause their union. Hence such a pair of bubbles form a delicate test for small quantities of electricity. The blowing of bubbles inside others, although apparently a very simple matter, is really a difficult feat to accomplish. Newton devoted much thought to the study of soap bubbles. He observed that, as the liquid thins away from the top of the bubble, coloured rings grow in regular order, spreading outwards till they attain their greatest diameter: then they close in gradually on the under side and vanish at the bottom. The colours pass through the most beautiful tints, eventually becoming dark red; then they increase in lightness to a dirty-white, which again darkens, till at last a black spot appears at the top, and this reaches a diameter of $\frac{1}{2}$ or $\frac{3}{4}$ of an inch, and then the bubble bursts. As a bubble is blown larger and larger its skin resists stretching, and Lord Kelvin has shown, in his lecture on the size of atoms, that the film could not keep up its tensile strength to the point when its thickness is as little as $\frac{1}{10000000}$ of a centimetre; but he says it is scarcely conceivable that there can be any falling off in this tensile strength as long as the film is several molecules in thickness; hence, when the tensile strength fails, *i.e.* when the bubble bursts, we can assume the film is only a single molecule thick. The thickness of the black spot has been shown by Professors Reinold and Rücker to be only slightly more than $\frac{1}{1000000}$ centimetre, and, as the film breaks soon after this spot appears, it is probably then something like $\frac{1}{10000000}$ centimetre thick. This, therefore, is the order of size of a molecule of water.

Soapstone. [STEATITE.]

Soapwort (*Saponaria officinalis*), a shrubby plant belonging to the order Caryophyllaceæ, with broad leaves and a large paniculate cyme of

fragrant rose-coloured flowers, often double. It is not uncommon as an escape from cultivation. The whole plant is saponaceous, the root being employed in Asia Minor to bleach silk and wool and give them a lustre.

Sobieski. [JOHN III. OF POLAND.]

Socialism. The modern movement covered by this name must be looked at in two aspects. It expresses, with more or less consciousness, a religious or spiritual impulse, and it advocates practical measures for readjusting the forms of society, more especially (at this moment) industrial forms, so as to give fuller expression and satisfaction to the promptings of that impulse. In the spiritual direction it shows Hegel's definition of religion, as "the knowledge by the Finite Spirit of its essence as Absolute Spirit," reflected in the Christian doctrine of the brotherhood and equality of men without distinction of class or nation (on which the "Christian Socialist" school is based), and paraphrased in the revolutionary watchword, "Liberty, Equality, Fraternity," entering into the secular-Socialist analysis, which exhibits each individual as produced, and his abilities and powers as conditioned by, and therefore as due to, Society. Inasmuch, however, as this impulse seeks form in conscious life, and mere bodily sustenance is the first condition of life for the individual, the Socialist movement appears, over much of its recognised area, as concerned with a material aim, *viz.* the establishment of the primary basis of tolerable human existence. And, broadly, whereas the social theory of Individualism asserts free competition as the safest method for the establishment of this material basis, and encourages the belief that the market price of each man's abilities and the total wealth that the arrangements of society may enable him to amass (no matter at what cost to his fellows) represent the true value of those abilities and are produced and justly earned by that man, the Socialist theory asserts that organised and intelligent combination is the more rational and effective means to this end, and that, as the very existence of any form of society implies a large measure of co-operation, whether deliberately or automatically established, it is impossible to attribute, as of right, any portion of the social product to any particular individual. It therefore prescribes as the canon of production and distribution the formula, "From everyone according to his abilities; to everyone according to his needs."

The Socialist or concrete view of society as a living organism of which individuals are members, as leaves of a tree, produced by it and, in their turn, building it up, as opposed to the individualist or abstract view, underlies and is very clearly expounded in the political speculations of Plato (*see especially Republic*) and Aristotle (*Politics*). Mr. Ruskin has been, perhaps, its most vivid and stimulating exponent in this century. Mediæval revolutionary movements, such as the English, and especially the German, peasant revolts, though provoked by economic oppression, very generally expressed their aspirations in the precise terms of modern Christian Socialism and their political

demands in formulas still accepted by contemporary Social Democracy. Forms of Communism, especially in land, and revolts of the poor against rich oppressors, have been exemplified in most countries and ages. The name *Socialism*, however, and the practical activity of the contemporary Socialist movement, both in its industrial aims and in its speculative influence, date from the earliest quarter of the current century.

The movement first found notable expression in the doctrines and activities of Robert Owen in England and Saint-Simon and Fourier in France. It appeared as a revolt against the condition to which the majority of the peoples of those two countries had been, or were being, reduced by the revolution in industrial processes brought about by the inventions of machinery, steam-power and the factory-system of production. The fact that the private ownership of land gave to its possessors power and practical ownership over those who cultivated the land had been a cause of social trouble long familiar to all European nations. The evil had been mitigated, and its essential nature concealed, in England especially, by the substitution of money rents for personal service from tenants; but already economic writers had advocated the nationalisation of land as the only remedy for the power of private landowners to dictate to other citizens the terms on which they should be allowed to earn their living.

The Socialists pointed out that the substitution of the factory system of production, in which masses of men are employed with expensive machinery, for the system under which the craftsman had owned his own tools and produced his work independently, or as one of a small democratic group, and disposed of it himself in open market, had reduced the bulk of the workers, especially in England, where the manufacturing industry was most advanced, to a position in which they were necessarily dependent upon the owners of capital for leave to work for their living, and were compelled to sell their labour for a price, determined, not by the market value of its product, but by competition among themselves which tended (as the political economists insisted) to reduce wages to just such a level as would enable the workers to live and maintain their class. The surplus of the value of the product over the wages thus assigned to the worker, is retained under this system by the capitalist, as rent is retained by the landlord, without any intervention by either in the processes of production. For the owner of the capital, such as a shareholder in a railway, is to be distinguished from a manager or organiser of labour, whose remuneration is of the nature of wages, and is determined by its value in competition. This system, whilst enormously increasing the power of man to satisfy his wants, had turned to the advantage chiefly of the owners and organisers of capital, leaving the mass of wage-earners poor, and with no control over their opportunities of livelihood, whilst the vicissitudes of blind competition continually disorganised production, ruined employers, and threw wage-earners out of employment.

This analysis, most completely elaborated by Karl Marx in his work on *Capital*, is the basis of the practical programme of Social-Democrats, generally described as Collectivism. It aims at placing the ownership and control of capital, and the organisation and direction of industry, in the hands of the workers of all kinds, and eliminating the sleeping partner that draws profits on account of mere ownership whilst dictating the conditions of employment. The Co-operative movement in England, inspired by the Socialism preached by Robert Owen, set out with this object in view. It has had much success in effecting organisation of distribution, but very little in the department of production. The German school of Socialists, of which F. Lassalle was the earliest conspicuous politician, has generally held that this transfer of ownership and control could only be effected through the instrumentality of the State; pointing out that the failure of the Co-operative movement in productive industry was due to the inability of workers without capital to compete successfully against the organised power of the capitalist employing class. Lassalle therefore argued that the State should give credit to groups of workmen to enable them to engage in production. This programme had but short vitality, and the Social Democratic movement of to-day aims nowhere at enabling sections of workmen in particular industries to become owners and controllers of capital, to be used for their benefit as a group, but always at effecting the transfer of such ownership or control to the national or local community through the forms of political democracy. The aim of the Collectivist movement is to effect in the industrial world what the democratic movement has aimed at in the political world; and, just as it is a matter of controversy and experience which branches of political administration should be regulated through the national Executive, and which through local and municipal authorities, so it is recognised that the administration of industry on Collectivist principles must necessarily exhibit various degrees of centralisation.

Whilst, therefore, Socialists habitually speak of the transfer of ownership to "the State," the form of their practical proposals varies greatly, according to circumstances. The highly-centralised German system of government is reflected in the comparatively centralising tendency of the German Socialist party (which now numbers about one million electors and holds 36 seats in Parliament). In France and Italy the long-established and extensive autonomy of local communes inspires a more general inclination towards the advocacy of decentralisation. The recognition, however, of the fact that industrial and commercial class interests tend more and more to transcend not only local, but national, limits, that important industrial services are very generally most efficiently provided through combination of capital and concentration of control, and that the effect of the private ownership of capital is continually to promote such combination, counterbalances the tendency to distrust that extension of bureaucracy which seems to be involved in centralisation, and the

hesitation to attempt the difficult task of establishing democratic control over productive and distributive industries.

In England the Collectivist movement has made gradual but continuous progress, through the legal regulation of hours and conditions of work and the municipal acquisition and administration of property and industries. The Poor Law and, much more notably, the Education Law are embodiments of Socialist principle, whilst the principle of regulating wages by democratic consent, instead of by competition (one of the earliest projects of Socialists), has recently (1894) engaged much public attention (in the form of the plea for "a living wage") and has established itself in the national arsenals and dockyards and in the election of many local authorities under pledge to pay "Trade Union" rates of wages to their employees.

Social Democrats, who form the majority of Socialists, aim, therefore, at abolishing the subjection of labour to capital, and the recurrent over-production and lack of employment, which are features of the competitive system, together with the social inequality between workers and possessors, by means of constructive organisation under democratic control: and they aim more and more universally at acquiring and establishing this control, not by any sudden revolutionary stroke, but by altering the laws and institutions of each country through their existing political machinery. Anarchism, which must be regarded as a branch of the Socialist movement, would abolish the subjection of the wage-earners by simple destruction of all existing organisation and authority.

Socinus, the Latinised form of the name of Soccini or Sozini, the descendants of a Tuscan banker named Sozzo, and the founders of the theological sect still known as Socinians.

(1) LÆLIO FRANCESCO MARIA SOZINO was born in 1525, and educated for the law at Bologna. He was drawn into the Evangelist movement, and after a stay at Venice, then the headquarters of religious reform in Italy, travelled through Switzerland, France, England, and Holland, making the acquaintance of Melancthon, Münster, Forster, and other kindred spirits, and ultimately settling at Zürich, where Calvin became a close friend. However, his speculative intellect raised questions as to the resurrection of the body, predestination, the sacraments, and the nature of the Trinity, which the latter declined to solve. He, nevertheless, came to no open breach, warned, perhaps, by the fate of Servetus, and died, in 1562, in some pecuniary straits, owing to the sequestration of his Italian property.

(2) FAUSTO PAOLO SOZINO, nephew of the foregoing, was born in 1539, and, inheriting fortune, led a rather desultory youth as a member of the famous Accademia degli Intronati. In 1562, after a short residence at Lyons, he joined the reformers at Geneva, and published the *Explicatio* of the proem to St. John's Gospel, in which he hardly recognises the divinity of Christ. He returned to

theology in 1570 with a treatise, *De Auctoritate S. Scripturæ*, and, settling at Basle, wrote *De Jesu Christo Servatore*. He now went into Transylvania, and thence into Poland, casting in his lot with the Antitrinitarians, though he never fully accepted their doctrines. His *De Jesu Christi Naturâ* was published in 1584. Hitherto he had written anonymously, but when the Holy Office at Siena deprived him, in 1590, of his estates, he threw off the mask. A mob at Cracow attacked him as a heretic, and he had to take refuge at Luslawice, where he died in 1604.

Sociology is the name given to denote the endeavours that have been made from time to time to investigate social phenomena and to establish some law governing their occurrence. In a wide sense it is coterminous with what the ancients called "Politics," but now it generally concerns itself with the actions of mankind as forming general society. The science rests on no assured basis, and, so far, the so-called laws seem in a great measure fanciful. Spencer is perhaps the greatest authority on the question as it exists at the present day.

Socotra, an island in the Indian Ocean, 120 miles E. of Cape Guardafui, and close to the mouth of the Gulf of Aden. The area is about 1,000 square miles, the shores being flat, but the central table-land attains a height of 800 feet. Great Britain annexed it in 1886.

Socrates, the son of Sophroniscus and Phæ-narete, a citizen of Athens, was born about 470 B.C., and followed at first his father's profession of sculptor, giving it up to start on a sort of moral and intellectual mission, to which he was urged, he conceived, by divine impulse. However, he discharged the duties of a citizen; first as a soldier at Potidæa, Delium, and Amphipolis (where he showed courage and steadfastness), later as a senator, when he boldly resisted unconstitutional measures. But the work of his life was to convict his fellow-creatures of ignorance, and, above all, to expose the spurious teaching of the Sophists. His method was to lead chance people, whom he met in the public places, into conversations on moral and social topics, and by a skilful process of questioning, to unveil the falsity or inadequacy of their ideas and principles. The results were negative, though the tendency of the process was towards establishing a higher ethical standard than that of the age. Many took part in the discussions as mere lessons in the art of verbal fencing. A smaller number sought counsel and strengthening for the duties of life; whilst a few grasped the true significance of the master's mission, and formed the nucleus of a school. The power of the man may be inferred from the fact that characters so widely different as Plato, Alcibiades, Xenophon, and Critias came under his influence. Personally he was short, stout, grotesque and sensual in feature, his appearance suggesting a Silenus rather than a saint, yet his habits were simple to austerity. He wore the same clothes summer and winter, dispensed with shoes, ate and drank like the

poorest slave, but did not abjure social pleasures or advocate asceticism as an end in itself. Ironical humour was one of his most potent instruments, but he used it as a philanthropist, and for grave wrongs he had sterner weapons of direct reproof. Socrates showed profound respect for even the conventional religion of his age and country, observing the usual rites, and accepting the signs and oracles, whilst he rejected the grosser legends and superstitions, which he attributed to lying poets. He claimed, however, to have a special divine sign or voice, sometimes called his "dæmon," and the precise nature of this belief of his has provoked much controversy. Probably he meant no more than is expressed by our word conscience, with the addition of a direct religious sanction, such as fervent piety often accepts as an objective phenomenon. With his wife, Xanthippe, a shrew, and a woman incapable of appreciating his aims, he seems to have led a wretched existence, tempered by his philosophic forbearance. Though opposed to the oligarchical tyranny of the Four Hundred and the Thirty, Socrates was even more adverse to the unmixed democracy, with its election by lot and its payment for political services. Accordingly, on the triumph of the demagogues, he was in 399 accused of denying the gods and corrupting the young, and being convicted by an overwhelming majority of the jury, was sentenced to death. He passed thirty days before execution in the noble discourses on the immortality of the soul, which are recorded in Plato's *Phædo*, drank the cup of hemlock, and died.

Socrates of Byzantium is only known to us through his *Ecclesiastical History*, which takes up the thread of Eusebius in 306 A.D., and carries it on to 439. He used materials provided by earlier writers, but introduced a good deal of oral tradition and contemporary information. Origen is his hero, and he occupies a middle position between the Athanasians and Arians, but dislikes dogmatic refinements and protests against persecution. He probably flourished between 380 and 450 A.D.

Soda. The substance known under the name of *soda* consists chemically of the carbonate of sodium, Na_2CO_3 , in combination with water. The ordinary washing soda has 10 molecules of water—i.e. $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ —but loses some of it when exposed to the air. The carbonate of sodium is obtained, to a small extent, naturally, forming deposits upon the soil, and existing dissolved in *soda lakes* in Egypt and Hungary, and in the water of many geysers. Formerly also quantities of the compound were obtained from marine vegetation under the name of *barilla* (q.v.); the greater quantity, however, is obtained by artificial preparation from salt by one of two processes: (1) the Leblanc; (2) the ammoniacal process. In the first, the salt is heated with sulphuric acid in a furnace constructed for the purpose; *sodium sulphate* and *hydrochloric acid* result—



The sodium sulphate known as *salt cake* is then powdered, mixed with powdered limestone and

coal, and heated strongly in another furnace. The fused mass, known as *black ash*, consists of soda and calcium sulphide, and from it the soda is dissolved out by warm water and recrystallised. In the ammoniacal process ammonia gas and carbonic acid are passed into a strong solution of brine, when bicarbonate of soda and ammonium chloride result, the former being converted into sodium carbonate by heating, and from the solution containing the ammonium chloride the ammonia is again evolved by the addition of lime. Soda crystals, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$, crystallise as large, prismatic crystals of the Monoclinic system, and dissolve in 2 parts of water at 38°C . The anhydrous sodium carbonate is a white powder which fuses to a porcelainous mass at about 800° . The *bicarbonate of soda*, NaHCO_3 , forms a white powder which is not as soluble in water as the previous salt. Soda is very extensively used in a great number of technical and manufacturing processes as well as in pure chemistry. Thus it is an important adjunct in many metallurgical processes, is employed in the manufacture of glass, soap, and of paper, and in the operations of bleaching and dyeing.

Soda, CAUSTIC. [SODIUM.]

Sodium (NA 23). Although not occurring naturally in a free state, this metal is, in combination, one of the most abundant of the elements. As common salt it occurs largely dissolved in seawater, salt lakes, and in saline deposits; it is found as nitrate in deposits on the soils in Chili, etc.; and occurs also naturally as carbonate, phosphate, and borate. The silicate exists in many rocks and minerals, being an important constituent of the *micas*. It is also found in many plants, particularly in marine vegetation. The metal itself was first prepared by Sir Humphry Davy, who obtained it in 1807 by the electrolysis of the fused hydrate. It is now manufactured by strongly heating a mixture of carbonate of soda and charcoal in iron retorts, recent years having brought great improvements in the details of the process. It is a silver-white metal, soft enough to be easily cut by a knife. It is a little lighter than water, having a specific gravity of .97. It melts at 97.6°C ., and may be volatilised in absence of air, the vapour being of a blue colour. If exposed to the air, the surface of the metal immediately tarnishes and becomes covered with a coating of the hydrate. If placed upon water, it immediately melts into a small ball, which floats upon the liquid, decomposing it with the evolution of hydrogen—



The substance NaOH which is formed is known as *sodium hydrate* or *caustic soda* and remains dissolved in sea water, to which it imparts powerful alkaline properties. It is a white solid which is prepared usually by the action of milk of lime upon a boiling solution of sodium carbonate. It is a strong caustic and alkali, and is extensively used for technical, chemical, and manufacturing purposes. Sodium forms two oxides, which are, however, unimportant. Among its salts, however, are many important compounds. The carbonate is

known under the name of *soda* (q.v.), and the nitrate forms the compound *Chili saltpetre* (q.v.). The *silicate* is soluble in water, and is known as *soluble glass*, being employed for fire-proofing, etc. The phosphate is important chemically, and the *borate* [BORAX] has many applications. The soaps are also but sodium salts of certain organic acid, while common salt is the chloride of sodium, NaCl. The metal itself is used in the preparation of other elements, notably *aluminium*, the recent falling in the price of this metal being chiefly due to the improvements in the processes of obtaining sodium.

Sodom, the chief of the Cities of the Plain, was, according to the Hebrew Scriptures, destroyed, along with Gomorrah, Zeboim, and Admah, by fire from heaven as a punishment for its vices, Lot and his family alone escaping. The site is supposed to be marked by the Dead Sea, called by the Arabs "the Sea of Lot."

Sofia, or TRIADITZA, the capital of the principality of Bulgaria, is situated on the river Isker, 170 miles north-west of Adrianople. It stands on a plateau on the north flank of the Balkans, and has a severe winter climate. The route from Belgrade to Constantinople passing through it brings a considerable trade, and there are some local industries, such as silken and woollen manufactures, tobacco, and leather. A palace was built in 1881 for the newly-elected prince [BULGARIA], and there are Greek and Romanist archiepiscopal residences, handsome baths and mosques, with other public buildings.

Soft Water. [WATER.]

Soils, ORIGIN OF. The name "soil" is generally applied to the disintegrated surface of rocks penetrated, or at least penetrable, by plant roots. Soils may be of two widely different origins: they may be *local*—derived, that is, from the decomposition of the substratum; or they may be *transported*. As examples of the former we have sandy soils on sandstone formations and clays, not only on clays and slates, but also on chalk and limestone. In this last case the carbonate of lime, which forms the bulk of the underlying rock, may be entirely removed by the percolating action of water, the clay being merely an insoluble residue. On the Upper Chalk it contains flints. Transported soils are of three classes—*cluvial*, carried by wind, such as blown sand and loess (q.v.); *diluvial*, carried by the ice of the Glacial Period, such as boulder clay and gravel, sometimes very chalky; and *alluvial*, carried by river-action, such as some sands and gravels and most loam or brick-earth. Soils often contain a considerable admixture of humus (q.v.), or decayed vegetable matter (leaf-mould), which in some cases constitutes what is known as black land. Soils are commonly classified as *rich* or *poor*, according to the large or small proportion of this ingredient; and as *stiff* and *cold*, if mainly clay, or *light* and *warm*, if mainly sandy or calcareous.

Soissons (anciently *Noviodunum* or *Civitas Suessionum*), a town of France in the department of Aisne and on the right bank of the river Aisne. A

flourishing tribal centre in Cæsar's time, it played an important part under the early Frankish sovereigns, and after the death of Clovis gave its name for a century to a small kingdom, which was merged in Neustria about 613. The Counts of Soissons remained powerful vassals until the 17th century, and from them sprang, in female descent, the house of Savoy-Carignan. The town is well built and chiefly modern, but the cathedral (12th to 13th century), the abbey-church of St. Leger, the remains of the ancient foundations of St. Médard, and St. Jean des Vignes, are among the most interesting monuments in France. A bishop has his seat here. Soissons has stood half a dozen sieges, resisting the Allies in 1814 and the Prussians in 1870, and has been the scene of several councils and congresses.

Sokoto, a Fulah kingdom in the Niger basin of Central Africa, having Bornu to the E. and Gando to the W., the river Binué forming the S. boundary. With Adamawa it covers an area of about 180,000 square miles. All the cereal crops of Africa are grown, and fruits of various kinds abound. Cotton and indigo and Shea butter are among the more valuable products. Iron is everywhere plentiful, and other minerals are known to exist. All this tract came under the influence of the Royal Niger Company by its charter of 1886, and was by a proclamation included in the British Protectorate of the Niger Districts.

Solanaceæ, a considerable order of gamopetalous dicotyledons, comprising some 60 genera. They are mostly herbs or shrubs, more abundant in the tropics than in temperate latitudes, and in America than in the Old World. Their leaves, though truly scattered, are often geminate, owing to local want of separation between the stem and a petiole. The inflorescence is similarly often extra-axillary. The flowers are generally polysymmetrically and isostemonously pentamerous, *i.e.* there are five sepals, five petals, and five stamens, with two many-ovuled united carpels. There is little to separate the order from the more polysymmetric genera of Scrophulariaceæ (q.v.), save its generally narcotic properties. It includes the genera *Solanum*, in which are the potato and the bittersweet, *Capsicum* (q.v.), *Nicotiana*, the tobaccos (q.v.), *Petunia* (q.v.), *Hyoscyamus*, the henbane (q.v.), *Atropa*, the deadly nightshade (q.v.), *Lycopersicum*, the tomato (q.v.), etc.

Solan Goose. [GANNET.]

Solano. [SIMOON.]

Solanum. [SOLANACEÆ.]

Solar Microscope is really a form of lantern used for obtaining upon a screen immensely-magnified images of minute objects. It is necessary that a small object should be enormously illuminated, for the greater the magnification obtained the less bright is the image compared to the object. For this reason it is convenient, when possible, to use the rays of the sun. A plane mirror is so placed that it reflects the sun's rays down the tube of the instrument, and the tube is often conveniently fixed in a hole in the shutter of

a window. These rays, being parallel, are refracted by a powerful convex lens of short focal length to its principal focus, near which the object is placed. The rays then pass through another convex lens or set of lenses, from which they diverge on to the screen. This arrangement can only be used for objects through which the light can pass; if opaque objects are used, a device is employed by means of which the sun's rays, after passing through the first convex lens, are reflected by a second mirror on to the back of the object, and thence proceed to the magnifying lenses as before. Since the sun's rays are seldom at our disposal, another source of light has frequently to be used; the most brilliant substitute is the electric arc, but, in the absence of this, the oxyhydrogen limelight is employed.

Solar System consists of the sun, the planets and their satellites, the planetoids, and such other masses of matter as are influenced in their motion by the attraction of the sun. Although the planets are popularly regarded as being affected by the sun alone, it must not be forgotten that every member of this system exerts an influence upon every other member, the amount of such influence depending only on the masses of, and distances between, the bodies under consideration. The following is a list of the principal members of the Solar System with a few numerical data :—

	Mean Distance from the Sun in Miles.	Periodic Time.	Diameter in Miles.	Time of Rotation on the Axis.	Mass compared with the Earth = 1.	Density referred to Water = 1.	No. of Satel- lites.
Sun	0	—	852,584	25 days 10 hours	354,936.0	1.37	
Mercury	35,000,000	88 days	3,060	24 hours 5 minutes	.12	6.77	0
Venus	66,000,000	224 days	7,608	23 hours 21 minutes	.38	5.30	0
Earth	92,800,000	365 days	7,926.6	23 hours 56 minutes	1.00	5.46	1
Moon	—	27 days 8 hours	2,153	27 days 8 hours	.013	3.44	
Mars	139,000,000	686 days	5,000	24 hours 37 minutes	.13	3.93	2
Jupiter	483,000,000	11.86 years	88,200	9 hours 55 minutes	316.03	1.31	5
Saturn	872,000,000	29½ years	74,000	10 hours 29 minutes	101.06	.71	8
Uranus	1,754,000,000	83 years	33,024	?	14.29	.82	4
Neptune	2,750,000,000	155 years	36,620	?	24.65	1.47	1

[PLANETS, PLANETOIDS, SATELLITES, SUN, MOON, EARTH, MERCURY, VENUS, MARS, JUPITER, SATURN, URANUS, NEPTUNE, ETC.]

Solder, an alloy which is employed for uniting together two metals. The alloy is one which fuses easily, and, when fused in contact with the metals, on solidifying adheres to both, and keeps them firmly fixed. It is necessary for soldering that the metallic surfaces are perfectly clean, the quantity of solder itself required being very small. For ordinary purposes solder consists of an alloy of about equal parts of lead and tin. Fine solder contains double the quantity of tin, and coarse solder double the quantity of lead.

Sole, any fish of the genus *Solea*, of the family of Flat Fishes (q.v.), with about forty species from temperate and tropical seas. Like the rest of the family, they are ground-fishes, and feed freely on other fish. Most of them are found round the coast, and some enter fresh-water freely, though all breed

in the sea. The eyes are on the right side; the mouth is narrow, and twisted round to the left; the dorsal fin commences at the snout, and does not join the anal fin, and the lateral line is straight. The Common Sole (*Solea vulgaris*) is a well-known and highly-valued food-fish, and the largest of the British species. It is taken more or less all round our coasts, but the North Sea is the best fishing-ground. The usual length is from ten to twenty inches, but much larger specimens are recorded. The colour above is brownish with black blotches. Other British species are the Lemon Sole (*S. aurantiaca*), the Banded Sole (*S. variegata*), and the Dwarf Sole (*S. minuta*).




Solenoid, in electricity, is a coil of insulated wire, usually hollow and cylindrical; its length is generally several times its diameter. A solenoid in the coils of which a current flows acts in most ways like an electro-magnet. An iron core introduced into such a coil is sucked in, and tends to move until the centres of coil and core coincide, and the pull exerted by a solenoid on its core is used for actuating the mechanism of arc lamps and other apparatus, in which a greater range of motion is required than can easily be obtained with an electro-magnet.

Soleure (Latin *Salodurum*; German *Solothurn*), a canton of Switzerland and its capital. The

former has an irregular area of 306 square miles, being almost entirely enclosed within Berne. It is exceedingly fertile, containing rich pastures, mines of iron and coal, valuable forests, and factories for glass, etc. The town boasts to be the oldest in Gaul after Trèves, and held the rank of an imperial city. It is picturesquely situated on the Aar about 25 miles S. of Basle, and has, among other interesting institutions, the finest armoury in Switzerland and a handsome modern church. The population is almost entirely Catholic, and the constitution of the canton, which has gone through remarkable changes, is now an ultramontane democracy.

Sol-fa, from the Do, Re, Mi, Fa, Sol, etc., of the musical scale, denotes generally music or notes without text or fixed time, used merely to exercise the voice and musical knowledge, in fact, the art of reading music. The chief systems are the fixed Do system, advocated by Hullah, the changeable Do system, and the Tonic Sol-fa (q.v.).

INDUSTRIES

Area of visible Coal Fields	Coal from the depth of 1000 to 2000 feet	Coal from the depth of 2000 to 4000 feet
		

Solicitor, the designation of a legal practitioner in the Courts Superior and Inferior. It was formerly restricted to practitioners in the Court of Chancery, "attorney" being the designation of a common law practitioner. By the Judicature Acts the term *solicitor* applies to all divisions of the Supreme Court. Solicitors are required to take out an annual certificate (£9 for London practitioners; £6 for country ditto); half these amounts only are payable during the first three years of their practice. They have previously to being articulated to undergo what is known as the "preliminary examination," being on the several branches of general knowledge. Midway of their service (which is five years, except for university graduates, when it is three years only) they have to undergo an "intermediate examination," and before being admitted to pass the "final examination" on the several branches of law £80 stamp duty is paid on the *articles of clerkship* (formerly it was £120), and somewhat heavy fees on their admission to practice. Solicitors are "officers of the court," which barristers are not. They (solicitors) are under stringent rules as to practice, and their conduct is subject to inquiry and control, the "Incorporated Law Society" having jurisdiction to consider and report to the courts thereon. In cases of flagrant misconduct they are liable to be struck off the rolls of the court; in lesser cases to suspension from practice for a certain term, and to costs occasioned by their misconduct. Their costs are subject to taxation by officers appointed for the purpose—in the Supreme Court "the masters"—and if a sixth part be taken off the solicitor has to pay the costs of taxation. This rule, however, only applies to costs between "solicitor and client," as it is termed, not to "party and party" costs.

Solicitor-General, a very important law officer of the Crown, ranking next after the Attorney-General, his functions being political as well as legal. Like the Attorney-General, he is not in the Cabinet, but changes with the Government of the day. He is almost always a member of the House of Commons, and acts as the deputy or assistant of the Attorney-General. He is usually knighted soon after his appointment, and succeeds the Attorney-General on a vacancy in that office. [ATTORNEY-GENERAL.]

Solifugæ, a group of Arachnida (q.v.), the members of which somewhat resemble the spiders in general appearance, but have a segmented abdomen. The group is of considerable biological significance; the best-known genus is *Galeodes*.

Solitaire (*Pezophaps solitarius*), a dodo-like bird, formerly living in the Isle of Rodriguez, which became extinct about the end of the 17th century. It was described by L  guat from personal observation, and in 1865 Professor Newton fortunately discovered bones enough to show that the description was correct. Since then other finds have made it possible to reconstruct the skeleton.

Solomon ("MAN OF PEACE"), the son of David by Bathsheba, succeeded his father on the throne of Israel about 1015 B.C., being then eighteen. He

began his reign by putting to death his brother Adonijah, and Joab, and by banishing Abiathar. He married a daughter of Pharaoh, allied himself with Tyre and other neighbouring nations, and set about the promotion of the political and commercial welfare of his country. The Temple was begun in 1018, and completed in seven years, and a palace was also built in Jerusalem, the walls and fortifications of which city were constructed anew. The naval power of Israel appears to have been vigorously developed. He devoted much attention to natural history, and even to the black art, if Arabian and Talmudic traditions may be credited. Many literary works were attributed to him; but, with the exception of Proverbs (q.v.), it seems probable that he had no part in these compositions. Ecclesiastes and the Song of Solomon undoubtedly belong to a later date, as does the Psalter bearing his name. Solomon expired in his fifty-eighth year.

Solomon Islands, THE, a group in the South Pacific lying N.W. of the New Hebrides, and S.E. of New Ireland, and extending in a double line for 600 miles, between the fifth and tenth parallels of south latitude. Seven members of the group are of large size, Bougainville, Malanta, Ysabel, Choiseul, and San Christoval being the chief, and the smaller islands number more than twenty. They are of volcanic origin, with fringing growths of coral, and Guadalcanal contains an active volcano. The central peaks attain a height of from 4,000 to 8,000 feet, and the soil is fertile and well watered. Owing to excessive rainfall the climate is unhealthy on the coasts, which are indented with many commodious bays. The natives belong to the Melanesian race, and present several marked characteristics. Bishop Patteson was the first who succeeded in establishing an influence over them. Discovered by Mendana in 1568, the group is still not thoroughly explored.

Solomon's-Seal (*Polygonatum*), a genus of liliaceous plants which derive their scientific name from their many-knee'd fleshy rhizomes. These give off tall, slender, drooping annual branches, bearing sessile broad leaves, either in two rows or in whorls, and axillary clusters of greenish-white flowers resembling bunches of seals hanging from a fob. The flowers are succeeded by bluish-black, berry-like fruits. There are three British species; but they are not common.

Solon, a descendant of Codrus and kinsman of Pisistratus, was born at Salamis about 638 B.C. Returning to Athens after a long voyage, he found the state torn by factions, undermined by the system of slavery for debt, and preyed upon by Megara. By a poem he stirred the citizens to recover Salamis, and was rewarded by being appointed archon. He at once set to work upon the reforms with which his name is associated. He wiped off all existing mortgages, classified the citizens according to property, gave votes to all, but limited the exercise of high office to the wealthiest, established trial by jury, and the elective council of 400, strengthened the aristocratic Senate or

Areopagus, invited foreigners to settle, as "metoikoi," under the protection of citizen patrons, regulated education, and introduced many social restrictions. He then bade farewell to his country for ten years in order to give his constitution time to get into working order. He visited Egypt, Cyprus, and Asia, held his memorable interview with Cræsus, and came home to find the old evils cropping up once more, and the tyranny of Pisistratus imminent. Between the latter and Solon there seems to have been some sympathy, though the lawgiver objected to absolute government. He died at the age of eighty before the new dynasty had fully come into power. Fragments of his poems have come down to us.

Solstices are those points of the ecliptic which are farthest removed from the equator. When the sun in his apparent path reaches either of these points, he appears stationary; hence the term solstice, from the Latin *sol* and *stare*. He then progresses no farther towards the poles, but returns towards the equator. At these two points the sun is vertical at the Tropics of Cancer or Capricorn; hence the solstices are also known as the *tropical points*. The term solstice is often used to denote the time when the sun reaches the two points. Hence in the northern hemisphere the summer solstice will be June 21, and the winter solstice December 21. The *Solstitial Colure* is a great circle passing through the solstices, and cuts both the equator and ecliptic at right angles.

Solution. Most liquids have the power of dissolving substances—that is, causing such substances to liquefy—and no liquid has this power so much as water. The dissolved substance may be either a gas or a liquid or a solid. When a gas is absorbed by a liquid, the amount dissolved varies with the temperature of the solution, the pressure to which the solution is subjected, and the nature of the gas itself. It is usual for the amount of gas contained in a solution to decrease with rise of temperature; thus the oxygen and carbon dioxide contained in cold water are given off on boiling. Henry discovered the law connecting the amount of gas dissolved with the pressure, and this law states that the volume of gas absorbed varies directly with the pressure. Thus, if water at ordinary pressure—i.e. under one atmosphere—will dissolve one litre of a gas, it will also dissolve *apparently* one litre under a pressure of two atmospheres; but one litre of the gas under two atmospheres is equivalent to two litres under one atmosphere, so we see that in the second case twice as much gas has really been absorbed. The amount of any gas dissolved from a mixture is determined by the pressure of that gas alone, and the law of such absorption is known as Dalton's law of partial pressures.

Usually a solid becomes more soluble in a liquid as the temperature rises; but there are a few exceptions to this, notably lime, which is much more soluble in cold than in boiling water. When the liquid will not dissolve any more of the substance, it is said to be *saturated*. In some cases, when a hot saturated solution is allowed to cool

slowly without agitation, the solid is not precipitated, and hence the solution contains at the lower temperature more substances than it would dissolve naturally at that temperature. Such a solution is said to be *supersaturated*. It is in an unstable state, and generally slight agitation, or the addition of a grain or two of some solid, will cause solidification to occur so rapidly that a rise of temperature is at once observed. Sodium sulphate shows this phenomenon exceedingly well, and it generally occurs best with those salts which contain a large amount of water of crystallisation.

When substances are dissolved in any solvent, the solution exhibits properties different from those of the pure solvent. Thus if a solution of sugar and water be contained in a tube, with what is known as a semipermeable membrane at its base, and this be placed in water, the solution rises in the tube, owing to the entry of water through the membrane, until a constant limit is reached. [OSMOSE.] There is thus a head of solution indicating a pressure, and this is known as the *osmotic pressure* of the solution. Osmotic pressure might be measured in other ways, and by means of this experimental quantity van't Hoff found he could apply thermodynamics to solutions, and hence originated what is known as the new theory of solutions. For dilute solutions at constant temperature it has been found that the osmotic pressure is proportional to the concentration, and further that the value of the osmotic pressure is the same as that which the substance would exert if it could be gasified and made to occupy (at the same temperature) a volume equal to the volume of the solution. It will thus be seen that in dilute solutions the dissolved substance behaves very much like a gas. It has been found also that the vapour pressure of a solution is lower than that of the pure solvent, and that the amount of lowering depends on the molecular weight of the dissolved substance. This causes the boiling-point to be higher, and the freezing-point to be lower, for a solution than for the solvent, and observations on these alterations of temperature are often used as a means of determining the molecular weight of a dissolved substance.

It has been found that salts, acids, and bases give abnormally large values of the osmotic pressure and related properties; they behave as though more molecules were present than are actually there, and hence it has been suggested that these substances have really dissociated. Since those substances which exhibit these peculiarities are always found to be conductors of electricity, a theory of electrolytic dissociation has been largely accepted. In the case of a solution of hydrochloric acid, for example, Faraday supposed each molecule consisted of two parts oppositely charged with electricity, thus $\overset{+}{\text{H}} \overset{-}{\text{Cl}}$. These parts he called the ions, and the passage of the current was supposed to consist of the movement of the two ions in opposite directions. These ideas of Faraday's have been supported by many workers, and in 1887 Arrhenius published his hypothesis that in such solutions a portion of the molecules exists

decomposed into ions even when no current is passing. It is not possible to expound this theory more fully here, but work done on solutions of many different electrolytes shows that, whatever may be the real state of an electrolyte in solution, the ion theory affords a reliable working hypothesis.

Solway Firth, an inlet of the Irish Sea dividing the county of Cumberland to the S. from those of Kirkcudbright and Dumfries to the N. It has a breadth of 20 miles at its opening, and diminishes to 2 miles at its E. extremity, where extensive tracts of sand are exposed at low water. Its length is about 40 miles. The Nith, Annan, Esk, Eden, Weaver, Derwent, and other rivers flow into it. A famous railway viaduct 1,960 yards long spans the tidal creek between Bowness and Annan. Solway Moss, 7 miles in circumference, the scene of the defeat of James V. in 1542, lies a little to the N.E.

Solyman II., SOLIMAN, or SULEIMAN, "THE MAGNIFICENT," succeeded his father, Selim I., as Sultan of Turkey in 1520. Having made peace with Persia and quelled a rising in Syria, he directed his arms westward, captured Belgrade and Rhodes, and ultimately pushed on to the gates of Vienna (1529), whence, after three weeks' siege, he had to retreat. He attacked Venice, but ultimately came to terms with Charles V. in 1538. In 1534 he renewed war with Persia, took Tauris and Bagdad, but was beaten before conquering Yemen. Tunis and Algiers and parts of Greece were added to his empire. In 1540 he again invaded Hungary and annexed the greater portion of it. Responding to the invitation of Francis I., he sent a fleet under Barbarossa to co-operate with the French against Charles V. A second expedition to Persia in 1547 resulted in the conquest of Georgia. From 1552 to 1562 he was engaged in fresh hostilities against Hungary, and in 1565 he brought a great armament against Malta, failing to take the island. He died in 1566 at Szigeth whilst opening a new campaign against Hungary.

Soma, in Hindu mythology, is closely connected with Indra, as the deity of light and fire, inspiring courage, poetry, and song, and bestowing long life, joy, and immortality. Later on he is absolutely identified with the moon. In one of his aspects the god appears as the soma plant, a kind of milk-weed, from which is extracted an intoxicating liqueur, used freely in the rites of this divinity. The beverage is prepared with mystic solemnities prescribed in many of the most ancient hymns of the Rigveda-Sanhitâ, and the plant is itself made an object of worship.

Somali, a people of East Africa, whose domain comprises most of the eastern peninsula terminating at Cape Guardafui, and stretching from the Gulf of Aden south to the Tana river, with undetermined western limits towards Gallaland and Abyssinia. The Somali, who belong to the Ethiopic or eastern branch of the Hamitic family (q.v.), intermediate between the Western Gallas and Northern Afars (Danakil), form three main divisions, with several important sub-groups, as under: (1) *Hasiya*

(Mijertin, War-Sengali, Dolbohanti, Habr-Awal, Habr-Tol, Habr-Yunis, Issa, Gadibursi), from Tajurah Bay round to the Indian Ocean, and from the Gulf of Aden south to the central plateau of Ogaden; (2) *Hawiya* (Habr-Jaleh, Habr-Gader, Karanlé, Rer-Dollol), Ogaden and Webi-Shebeli basin; (3) *Rahanwin* (Kalalla, Barawa, Wadan, Abgal), southern steppes, Juba basin, and thence to the Tana estuary. The type differs little from that of the Gallas (q.v.), except that the Somali are taller (5 feet 10 inches to 6 feet), and darker (a deep shade of brown), with smaller and longer heads, slightly arched nose, full lips, deep-set black eyes, long crisp black hair, slim extremities; but there is a strain both of Arab and Negro blood, causing considerable modifications in different districts. All are Mohammedans, and the little culture they possess, such as a slight knowledge of letters, and the national costume (a flowing robe of white cotton, clasped to the left shoulder), is entirely due to their Arab teachers. Beneath this outward varnish the savage instincts are still rampant, as shown in the prevalence of brigandage, lawlessness, tribal feuds, the vendetta, and a curious indifference to physical pain. All go armed, the national weapons being the spear, long knives or daggers, and the *sif*, a two-edged sword, reserved for the chiefs. These chiefs possess little authority over the innumerable *vers* or *fakidas* (clans and septs), and even the so-called "Sultans" of the Hasiyas exercise scarcely any influence beyond their immediate surroundings. The coast people engage in fishing, navigation, and trade, or seek employment as caravan leaders. In the interior nearly all are nomads, and possess a fine breed of camels, noted for extraordinary staying power. By the recent international conventions the Northern Somali have become British, the Southern Italian subjects, though few of the inland tribes are yet aware of this political arrangement.

Somersetshire, a county in the S.W. of England, bounded N.E. by the Bristol Channel and the Severn, and inland by Gloucester, Wilts, Dorset, and Devon. The area of 1,640 square miles consists of marshy levels on the coast, slaty cliffs to the E., and alluvial plains or valleys to the S. divided by the bleak ranges of the Mendip, Polden, Quantock, and Brendon Hills, and the plateau of Exmoor. The chief rivers are the Avon, Parret, Yeo, and Ax. The soil is good in the lowlands, the Vale of Taunton yielding heavy grain crops, and the pastures supporting large herds of cattle, whilst sheep thrive well on the hills. Some coal is found in the E., but the chief mineral resources are Bath-stone, slate, iron, and lead. Woollen goods, gloves, lace, paper, and Bath-bricks are the only industrial products. Bath, the capital, is famous for its waters, and other centres of population are Taunton, Bridgwater, Chard, Wells, Yeovil, and Glastonbury.

Somerville, MRS. MARY (1780-1872), was the daughter of Vice-Admiral Sir George William Fairfax. She taught herself mathematics, but her real progress in science began in 1812, when, having lost her first husband, Captain Greig, she

married Dr. Somerville, inspector of the army medical board. She acquired a deep knowledge of astronomy and physics, and was intimate with Laplace and other learned men. Her first work was a translation of the *Mécanique Céleste*, and in 1834 appeared *The Connection of the Physical Sciences*, followed in 1848 by her *Physical Geography*, and in 1869 by *Molecular and Microscopic Science*. She was elected an honorary member of the Royal Astronomical Society, and received a Civil List pension.

Somme, THE, a river of France, which rises in the department of Aisne, flows W. through that of Somme, and passing St. Quentin, Ham, Amiens, and Abbeville, enters the channel between St. Valéry and Le Crotoy, after a course of about 125 miles. Owing to the silting up of its mouth, a canal connects it with the sea. The department to which it gives its name lies between Pas de Calais, N. of Seine Inférieure, and Oise, S., and Aisne E. There are large factories for the weaving of velvets, moleskins, tulle, and other tissues, for making sugar and spirits, and for locks and other iron goods. Amiens, Abbeville. Montdidier, and Peronne are towns of importance.

Somnath, or SOMNATH-PATTAN, a decayed port of Gujerat, India, on the S.W. coast of the Kattywar peninsula, the marine quarter, Verawal, bearing traces of its ancient fortifications and commercial prosperity. The place takes its name from the great temple of Siva, the ruins of which attract many pilgrims. Mahmud of Ghazni (1024) carried off the famous gates, which are now at Agra.

Sonata, a musical composition, introduced and much used in the 17th and 18th centuries. It should have a single, common idea running through the movements, which are varied, and originally it was intended for one instrument, generally the violin, later the piano. If it is intended for more instruments than one, one instrument should always predominate in the same movement, and the others be looked on as accompaniments. Bach, Haydn, Mozart, Mendelssohn, and Beethoven are celebrated for their sonatas.

Song, a short poem, or set of words in rhythm, adapted to music. The song may be for a single voice, for a chorus, or a part-song, or all combined, and generally contains a story or sentiment, and should be directed to the emotions, sentiments, or passions. The national songs of England, Scotland, Ireland, etc., Dibdin's nautical songs, and the volks- and soldaten-lieder of Germany are good examples of what songs should be, as are also the short songs in Tennyson's *Idylls of the King*.

Songhay (SONRHAY), an historical people of West Central Sudan, whose empire, overthrown by the Moroccans in 1591, at one time comprised a great part of West Sudan and the Sahara, with Timbuktu and many other great cities. They still number about 2,000,000 along both banks of the Middle Niger from Lake Debo round to the Sokoto confluence, and at some points stretching as far as the Hombori Hills within the great bend of the

Niger. The Songhay language, which is of Sudanese type, but in other respects fundamentally distinct from all the surrounding forms of speech, is even still current in the Asben district, a proof of the former great extent of their empire towards the east. But nearly all are now subject either to the Tuaregs or to the Fulahs of Sokoto and Gando, or to the French since the occupation (1894) of Timbuktu. The culture is purely Mohammedan, but the type Negroid, that is, Negro much modified by Arab and Tuareg (Berber) interminglings. (Barth, *Travels*, vol. v.)

Sonnet, a short song of fourteen lines, generally containing a single idea or sentiment. It seems to have first appeared in Italy, perhaps in Bologna, in the 13th century, and later in other countries. The kinds are chiefly two: the simple stanza (as Shakespeare's), and the compound stanza (as Petrarch's). The simple stanza consists of three quatrains of lines rhyming alternately, and ending with a couplet; the compound of eight lines rhyming 1,4,5,8: 2,3,6,7: and six lines of two or three rhymes, varying in order. Among English writers of sonnets are Shakespeare, Drayton, Keats, Wordsworth, and Milton.

Sonora, a state of the Mexican Republic, occupying an area of 79,000 square miles between the lower spurs of the Andes and the shores of the Gulf of California. The flat regions near the coast are very fertile, but are often broken up by marshy lagoons. The Sonora river, the Rio Colorado, the Mayo, and the Yaqui drain the country. Hermosillo is now the chief town, Ures and Arispe having formerly held that position.

Sonthals (SANTÂL), a large Kolarian nation of East Central India in Bâghalpûr, north-west of Murshedabad, reaching from the Daman-i-Koh (Rajmahâl) Hills on right bank of the Ganges southwards to about 24° N. lat. north-west of Calcutta. Chief tribal divisions: Saran, Murmu, Marli, Kisku, Basera, Karwar, Chorai. Many of the Sonthals engage themselves as coolies in the British colonies, and large numbers have become Protestants. Their language, reduced to written form by the missionaries, and spoken by over 1,000,000, is the best known, the most highly inflected, and by far the most important of all the Kolarian languages; but the type seems more Dravidian than Kolarian, almost round face, large mouth, tumid lips, flat forehead, moderately prominent cheek-bones, coarse, black, lank hair, short stature, robust constitution, showing a remarkable immunity from fever in malarious districts. This characteristic enables the Sonthals to work on plantations where the climate would be fatal to almost any other race. (Hunter, *Annals of Rural Bengal*; Dalton, *Ethnology of Bengal*.)

Soochoo, or SU-TCHOW, a large city in the province of Kiang-Su, China, about 60 miles N.W. of Shanghai, and close to Lake Tai-ho and the Imperial Canal. Outside the walls, which make a circuit of ten miles, are populous suburbs. The Taeping rebels took the place in 1857, and it was recovered six years later.

Sophia Dorothea of Zell, the only daughter of Duke George William of Brunswick-Lüneburg-Zell (or Celle) was born in 1666. At the age of sixteen she married Prince George Louis of Hanover, afterwards George I. of England, and bore him a son and a daughter, the first becoming George II., whilst the latter was mother of Frederick the Great of Prussia. In 1694 Sophia was discovered in an amorous intrigue with Count Philip von Königsmark, was divorced, and passed the rest of her days imprisoned at Ahlden, where she died in 1726.

Sophists, primarily professional teachers of rhetoric and other branches of learning in Greece in the latter part of the 5th cent. B.C. Professing as they did to teach the newest learning, they (or rather some of the most conspicuous of them) came to appear as a kind of sect or school of philosophers representing and intensifying the sceptical tendencies of the time. The earlier Sophists were declamatory and rhetorical: the later perhaps imitated Socrates' dialectic. They were renowned for their power in rhetoric and grammar, both of which subjects they taught for pay. Much of what we know of them is derived from Plato and Aristotle, who judged them by a somewhat transcendental standard. Protagoras, Gorgias, and Prodicus were among the leading Sophists.

Sophocles, the Greek tragic poet, was born in the deme Colonus of Athens about 495 B.C. Very little is known of his life. Tradition affirms that he led the chorus of boys who chanted in celebration of the victory of Salamis (480), and allusions in Aristophanes prove that he died not long before 405. He discharged his ordinary civic duties, appears to have served with Pericles as a general in the Samian War, was of a genial temper, and somewhat susceptible to the tender passion, and is rumoured to have become miserly in his later years. The well-known story of his reciting a passage of the *Œdipus Coloneus* to prove his capacity in extreme old age for managing his property rests on slender evidence. It is said that he produced his first tragedy in 468, wresting the prize from Æschylus, and he was twenty times successful, producing more than a hundred pieces, only seven of which are extant, viz. *Œdipus Tyrannus*, *Œdipus Coloneus*, *Antigone*, *Electra*, *Ajax*, *Philoctetes*, and *Trachiniæ*. He shows a distinct advance over Æschylus in dramatic construction, in simplicity of language, and in mastery of metre, but lacks the tragic intensity and lyrical power of the older poet. His patriotism, though noble, is less strenuous. On the other hand, he never sinks into the sickly and monotonous sweetness of Euripides. Consummate art marks every line of his works, and in this respect he still remains without a rival.

Sorbonne, THE, was a theological institution founded in the University of Paris in 1252 by Robert de Sorbonne, chaplain of Louis IX. It was intended for secular priests, who there studied and taught theology, and its members gained a great reputation, so that the Sorbonne had much influence in the ecclesiastical and social world.

It was suppressed and disendowed at the Revolution, but was afterwards revived. The building, which still retains the name, now belongs to the theological faculty of the university.

Sorel, AGNES (1409-1450), the mistress of Charles VII. of France; her influence over him was very beneficial.

Sorghum, a genus of grasses cultivated, under the names of Millet, Guinea-corn, Durra, etc., in many warm climates, and employed for various purposes. Among the Shaker communities of the United States sugar is manufactured from the stems. The grain is employed as food for poultry, horses, etc., and in India is eaten by the poorer classes. The stalks of the grain-bearing panicles are made into brooms, clothes-brushes, etc.

Sorrel (*Rumex scutatus*), sometimes distinguished as *French sorrel*, is a hardy perennial, native of France and Italy, introduced into the country as a vegetable in 1596. The blunt hastate glaucous leaves are more fleshy and less acid than those of the Common Sorrel (*R. Acetosa*), a British species that was formerly used in the same manner. Sorrel is rich in oxalic acid, and is considered a valuable antiscorbutic; but it is more eaten in France than in England.

Sortes Virgilianæ, a method of divination which consisted in opening by chance on a passage of Virgil, and taking the passage so found as prophetic. The ancients practised it, and in later times Charles I. and Lord Falkland found in this way a forecast of their eventual fate. Though condemned by the Christian Church, the same method of divining was applied to certain religious books, and the Bible is even now resorted to by some for the same purpose.

Sothorn, EDWARD ASKEW, born in 1830, was very early attracted to the stage, appearing at Boston, United States of America, in 1851. Seven years later he made a great hit at New York as Lord Dundreary in Tom Taylor's *Our American Cousin*, practically creating the character. In 1861 he brought the play to England; and acted it many hundreds of times at the Haymarket and in the provinces. This was his great success; for, though he obtained some popularity in *David Garrick*, *Brother Sam*, *Home*, and *The Prompter's Box*, he never quite got the same hold over the public. In 1878 he returned to this country after an absence of some years in America, and died somewhat suddenly in London in 1881.

Soubise, BENJAMIN DE ROHAN, DUC DE, was born about 1589, and began a soldier's career under Prince Maurice of Orange in the Netherlands. In 1621 he, with his brother, took the command of the forces of the Huguenots against Louis XIII., but, after some successes, was compelled to take refuge in England. In 1625 he resumed operations by a brilliant cutting out of the French fleet at Blavet, and he had charge of the defence of La Rochelle and the abortive expedition against the Île de Rhé. On the failure of his hopes he again withdrew to England, where he died in 1641.

Soubise, CHARLES DE ROHAN, PRINCE DE, born in Paris in 1715, being the son of a mistress of Louis XIV. Though an incompetent soldier, he was entrusted with high command by Louis XV., and in 1757 was ignominiously defeated by Frederick the Great at Rossbach. In the next year, under the guidance of Marshal d'Estrées, he to some extent retrieved his reputation, and in 1762 was successful at Johannisberg. His later years were spent at Court, where he enjoyed the patronage of Madame de Pompadour and Madame Dubarry. He died in 1787.

Soudan, or SUDAN (Arabic "Blacks"), is a somewhat vague geographical term used by Arabs to designate the habitat of the Negro tribes of Africa, and adopted by European writers without specific definition. Roughly speaking, the district thus named lies between 5° and 18° N. lat., and stretches from Cape Verd to Massowah, having the Sahara to its N., Guinea and the Congo territories to its S. The area considerably exceeds two millions of square miles, and presents marked physical contrasts with the northern and southern portions of the continent, being elevated, well-watered, fertile, and habitable. It is divided into the Western Soudan, comprising the Niger basin, the Central Soudan, which is drained into Lake Tchad, and the Eastern or Egyptian Soudan, which sends its waters into the Nile and its feeders. The first-named division is occupied chiefly by Bambarrah, the Fulah States, the Hausa and Tuareg tribes, and the territory attached to Timbuktu, the lower part coming under British protection. In the Central Soudan the principal states are Bornu, Kanem, Logon, Baghirmi, and Wadai. The Egyptian, Equatorial, and Bahr-Gazal Provinces, embracing Darfur, Kordofan, Senaar, and Taka, have since the Mahdi rebellion been more or less reduced to anarchy, but European influences are gradually being brought to bear on the region from the south. Ethnologically the vast majority of the population belongs to the Negro or Negroid race, Mandingoes, Hausas, Yorubas, Baghirmis, and Battas being marked varieties. Hamites, such as the Tuaregs, Fulahs, Serrakolets, etc., exercise a predominant power in the west, but their blood is often mixed with that of the Negro. Semites or Arabs do not settle much west of Kanem, but are the practical masters of all the Eastern Soudan.

Soul, a word of greatly varying and perplexing signification. By some it is used to signify the principle of life, by others the thinking and self-conscious part of man, and by others a certain inner man, independent of body or mind, constituting the real man as independent of mind and body, and outlasting them both, though the different parts will be united hereafter. But this last is rather a religious belief than a philosophical tenet, and indeed the whole question of the soul as such enters more into the region of theology than that of philosophy. As denoting the principle of sentient life, the soul seems to be as much an attribute of other animals as of mankind, and some have gone so far as to claim it even for plants. Possibly this idea gave ancient mythology its belief in the

Hamadryads. Much profitless controversy has been entered upon by people who differed upon fundamentals and so misunderstood each other's arguments. Butler makes much use of the soul argument in his *Analogy*.

Soult, NICOLAS JEAN DE DIEU, MARSHAL, DUKE OF DALMATIA, the son of a country notary, was born at St. Amans-la-Bastide in 1769, enlisted at the age of 16, and, having won his captain's epaulettes in 1793, in the following year leaped to the rank of brigadier-general for his brilliant services under Lefebvre in Flanders. Five years were now spent in Germany, where the battle of Altenkirchen added to his fame, and he next joined Massena in Switzerland, took a distinguished part in the battle of Zürich, and pursued Suvorof into Italy. He was wounded and taken prisoner outside Genoa in 1800, but got an exchange after Marengo. As marshal he commanded the centre at Austerlitz, and then won the battles of Jena, Eylau, and the city of Königsberg. In 1808 he began his protracted struggle against Wellington in the Peninsula, and in 1814 gave his services to the new dynasty, coming to England with the Allied Sovereigns. However, he went back to his old master for the Waterloo campaign, and then remained for four years in exile. Under Louis Philippe he became Minister of War, ambassador in London, and was loaded with honours. He declared himself a Republican in 1848, and died in 1851.

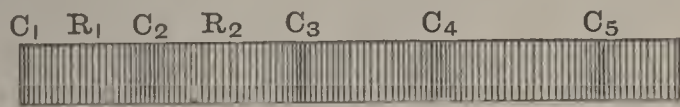
Sound. The sensation of sound is produced in the brain when the auditory nerve is affected in a particular way. Sound is transmitted through the air by means of waves; an original impulse given to certain gaseous molecules causes these to start outwards and, after hitting others, to rebound. These latter, in their turn, give up their motion to fresh ones, and so a series of to and fro movements is set up, the effect travelling outwards as a *wave*. As each particle starts forward it causes a condensation of air in front, and a rarefaction behind; while the wave travels onward in the same direction as that in which the molecules are moving. The faster the particles move to and fro the more quickly does the wave travel onwards, and, as the rate of rebound of the particles depends on the elasticity of the air, it follows that the velocity of sound also varies with this property. [ACOUSTICS.] The loudness of a sound diminishes as we recede from its source, and in such a way that the intensity is inversely proportional to the square of the distance; this is true if the sound be free to travel in all directions, but if the sound be forced to limit its direction this law does not hold. This limitation of direction is obtained when a person speaks into a tube: the sound as heard by a person some distance away is almost as loud as it is near the speaker.

A continuous sound may appear to us as music or as noise. If the sound-waves travel sufficiently rapidly, and follow each other with perfect regularity, we obtain a musical note, but directly the regularity ceases the music descends to noise. It might seem that the method of production would determine whether a sound were musical or not,

but this is not the case; regularity is the one essential. Savart's wheel is provided with a number of small cogs or teeth, regularly placed round its circumference. If the wheel be made to strike against a card as it rotates, a quick succession of taps is obtained, which gives a note when the speed of rotation is sufficiently high. In the siren (q.v.) air or steam is made to issue in quick, regular puffs, and so produce a note. In many other ways can musical notes be produced: by the vibrations of a stretched string, by the rapid oscillation of a clamped rod, or by the lightning strokes of an insect's wing. One of the commonest methods of getting a pure note is to throw a tuning-fork into vibration by drawing a bow across it.

SOUND.—
Fig. 1.

Although it is impossible to count the number of vibrations made by such a fork by merely watching it, yet the fork may be made to register its movements in a very simple way. A fine style is attached to one prong, and this is made to just touch a piece of smoked glass (Fig. 1). When the fork is sounding the smoked glass is quickly moved downwards with constant velocity. A series of tiny waves then appears on the glass. By counting the number of waves in any length, and knowing the velocity of motion of the glass, the number of vibrations can be found. It will be noticed that, as time goes on, the sound, although remaining the same note, gets less and less intense. This effect is shown on the blackened glass by the decreasing amplitude of the waves. The vibrations of a tuning-fork may also be exhibited by means of Lissajou's figures (q.v.). These vibrations set up a succession of



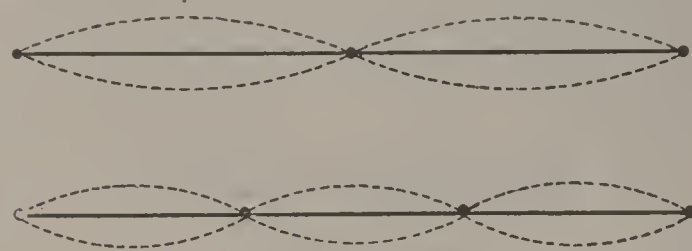
SOUND.—Fig. 2.

rarefactions and condensations in the air which may be thus exhibited, and the length of a sound-wave is the distance between points of the greatest condensation or rarefaction, *i.e.* C_1-C_2 or R_1-R_2 (Fig. 2).

The actual wave-length of any note in air is found by dividing the distance traversed by the sound per second by the number of vibrations per second of the tuning-fork. Taking the velocity of sound to be 1,120 feet a second at ordinary temperature, a fork giving 320 vibrations per second will generate waves $3\frac{1}{2}$ feet long. Since the pitch of a note rises with the increase in number of vibrations, it follows that in the same medium a high note is produced by shorter waves than a low note. The wave-length of a note is twice as much as that of its octave higher, and the waves produced by a woman's voice are only about a quarter the length of those produced by a man's.

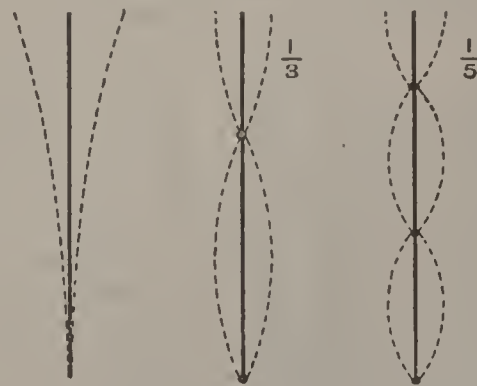
Temperature exerts its effects on the wave-length: the wave-length increases with rise of temperature when the rate of vibration is the same. The use of vibrating strings as a source of sound is exhibited in the violin and other musical instruments, but the vibration of the string itself

has to be taken up by a sound-board to make it produce an audible sound. The laws of vibrating strings can be experimentally found by means of the monochord (q.v.). It is then found that the rate of vibration varies—(1) inversely as the length of the string; (2) inversely as the thickness; (3) directly as the square root of the tension; (4) inversely as the square root of the density. If such a stretched string be touched at a point half-way



SOUND.—Fig. 3.

along it and a bow be drawn across one segment the string vibrates in two halves. If held at a point one-third of its length from one end, and the shorter part be agitated, it will vibrate in three parts (Fig. 3). The same sort of thing happens if the string be touched at points $\frac{1}{4}$, $\frac{1}{5}$, etc., of its length along it, the string vibrating in 4, 5, etc., equal segments. These segments are separated from each other by points at which there is no motion, and these points are called nodes (q.v.). When the string is halved, it follows that the rate of vibration is doubled, and the pitch of the note is raised, and we have, in fact, the octave; when the string vibrates in three parts we have the twelfth. Those notes which can be produced by dividing the string into any aliquot parts are known as the *overtones* or *harmonies* of the string. When it vibrates as a whole, the note is known as the *fundamental*; but when apparently vibrating as a whole, the smaller vibrations occur as well as the others, and the overtones are mingled with the fundamental; it is the presence of these overtones which gives *quality* to the sound produced. Some overtones are not a pleasant addition to the note; so in the piano, for instance, one of these discordant harmonies is avoided by making the hammer



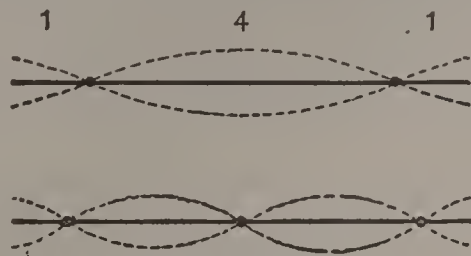
SOUND.—Fig. 4.

strike the wire at a point (about $\frac{1}{7}$ the length of the wire from its end) which would naturally be a node of that overtone, but which is now set in active motion.

The modes of division of a rod fixed at both ends, and made to vibrate transversely, are the same as those of a stretched string, but the rates of vibration are not the same. When the number

of nodes is 0, 1, 2, 3, etc., the rates of vibration are proportional to the numbers 3^2 , 5^2 , 7^2 , 9^2 , etc.

A rod fixed at one end may also vibrate as a whole or in segments, and the rates of vibration of the overtones are thus related (Fig. 4). If the rate of vibration of the fundamental be considered as proportionate to 2^2 that of the first overtone is proportional to 5^2 , and the rates of the first, second,



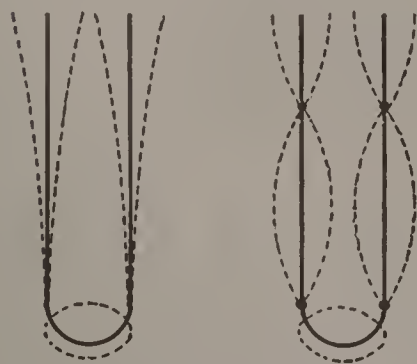
SOUND.—Fig. 5.

third, etc., overtones are proportional to the numbers 3^2 , 5^2 , 7^2 , etc. With rods of different lengths the rates of vibration vary inversely as the square of the length. This is the basis on which the musical box is constructed.

A rod free at both ends will vibrate in its simplest manner when possessing two nodes (Fig. 5). With 2, 3, 4, 5, etc., nodes, the rates of vibration are nearly proportional to 3^2 , 5^2 , 7^2 , 9^2 , etc. This system is used in the claquébois, but only the simplest method of vibration, viz. with two nodes, is employed. The vibrations of a tuning-fork are comparable with those of a rod free at both ends (Fig. 6). The fundamental has 2 nodes, the first overtone has 4;

there is no division of a tuning fork by three nodes. Chladni investigated the vibrations of plates and obtained beautiful figures—known as Chladni's figures—by strewing sand on the vibrating body, the sand distributing itself on the nodal lines. The overtones of plates and also those of cells are not simply related to the fundamental, so these bodies are not greatly employed in music.

The vibration of columns of air is made use of in organ-pipes. Pipes may be of two kinds, open at both ends or closed at one. In the tube closed at one end that end is necessarily a node, while the open tube possesses a node at the centre. The note



SOUND.—FIG. 6.

from an open pipe is therefore the octave of a closed pipe whose length is the same. In an open pipe the wave-length is twice the length of the pipe, in a closed one four times. In an open pipe the rates of vibration of the fundamental and overtones are proportional to the numbers 1, 2, 3, 4, etc., while in the stopped pipe they are proportional to 1, 3, 5, 7, etc. Reeds are often connected to columns of air and set up the vibrations [REED], and the choral chords of the human throat act like the reed of an instrument. Sounds often occur which are made up of a number of component notes. These can be sifted by means of resonators (q.v.), or by sensitive flames.

Simple sounds may be arranged in scales, the notes of the scale being related in a simple way; the rates of vibration are proportional to 24, 27, 30, 32, 36, 40, 45, 48, the number 24 representing the fundamental, and 48 the octave. Between any consecutive two of these numbers there are only 3 ratios or intervals, these are $\frac{8}{9}$ a major tone, $\frac{10}{9}$ a minor tone, and $\frac{16}{15}$ a limmar. To use this in practice would be inconvenient, so the octave is divided into 12 parts, the interval between two consecutive notes being the twelfth root of 2; this is known as a scale of equal temperament. Discord is produced when many notes are struck together, and if two consecutive low notes be sounded at once, that sort of discord is obtained which gives rise to audible beats (q.v.). Sound is propagated by waves in the same way as light. The laws of reflection and refraction are the same in both cases. Reflection is illustrated in the case of echoes, and refraction is exhibited when sound is concentrated by means of a lens containing a gas (e.g. carbonic dioxide) denser than air.

Sounding, the system of measuring the depth of water in rivers or the sea by means of a plummet and line.

South, ROBERT (1633–1716), a celebrated English divine, was born in Hackney, and was sent to Westminster School, proceeding thence to Christ Church, Oxford. He became in 1660 public orator of the university, and was rapidly promoted in the Church, though he declined to accept a see. He was successively chaplain to the Earl of Clarendon, Prebendary of Westminster, Canon of Christ Church, and rector of Islip in Oxfordshire. He was a strong opponent of the Dissenters, and poured all the wit and eloquence he possessed on them and their doctrines. He took no part in the furtherance of the Revolution, though he did not strenuously object to it. He was charged with heterodoxy for attempting to explain an inscrutable mystery in his famous controversy with Sherlock on the Trinity. His chief writings are his *Sermons*, which abound with wit and good sense, and are often very eloquent and refined. They form twelve volumes, and entitle South to a very conspicuous place in the roll of notable English preachers. He had a somewhat sarcastic temper, which he gave as his reason for refusing a bishopric.

Southampton, a municipal and parliamentary borough and seaport in Hampshire, situated on the Test at the head of Southampton Water. It forms a county in itself. The trading importance of the place dates from the Conquest, but has suffered sharp vicissitudes, though the natural harbour is almost unrivalled and possesses a double tide. It was for many years the starting-point of the Peninsular and Oriental Company's steamers for the East, and still retains the business of the Royal Mail and Union Lines, as well as of the London and South-Western Company's traffic with the Channel Islands and France. It is also a port of call for the vessels of the North German Lloyd and other foreign lines. The great tidal dock opened in 1842 and two other large docks have an area of

50 acres, and quite recently have been acquired by the railway company, and made the headquarters of the American line plying to New York. The modern town and suburbs are handsome and commodious, but preserve many traces of antiquity, such as parts of the walls and four gates dating from Richard II., remains of the castle occupying the site of a Saxon fort, the Norman churches of St. Michael and Holyrood, the French chapel of St. Julien, and a grammar school founded by Edward VI. but rebuilt in 1875. There are good public institutions and a pleasant park. It returns two members to Parliament.

South Australia, with the recent addition of Alexandra Land, extends from the southern to the northern coast of the Australian continent, a distance of nearly 2,000 miles, and has an area of 903,690 square miles. It is divided from West Australia by the meridian of 129° E., from New South Wales by that of 141° , and from Queensland by that of 138° . The southern coast line of 1,500 miles is deeply indented by Spenser, St. Vincent, and other Gulfs, and the northern coast offers many harbours. Except the Murray, there are no navigable rivers, but the southern part is well watered by small streams, and has several fine lakes, *e.g.* Torrens, Alexandrina, Eyre, Gregory, etc. The surface is level or undulating, the Gawler Range (2,000 feet), Flinders' Range (3,000 feet), and Mt. Bryant being the greatest elevations. The soil is generally fertile, and yields cereals, roots, excellent fruits, wine, oil, and even rice, but droughts are of frequent occurrence, and irrigation is necessary. From this cause pastoral progress is less marked than in other colonies, though wool is an important product and cattle thrive in the north. The climate is peculiarly healthy, and invalids are often sent from England for the benefit of the warm dry air. Coal is scarce, but copper, silver-lead, gold, and iron with other metals have been most profitably worked. Valuable marbles, slates, and building stones are also quarried. Much effort has been made of late to bring the wines and the fresh and preserved fruits of the colony into the European market. The first settlements were made in 1836, and were happily unconnected with penal emigration. Adelaide, Port Gawler, Albert Town, Port Wakefield, Port Elliot, Germantown, and Kapunda are the chief centres.

South Carolina, one of the original thirteen States of the American Union, occupies a triangular area of about 31,000 square miles, being separated from Georgia to the W. by the Savannah and Tugaloo rivers, having North Carolina as its N. and W. boundary, and extending along the Atlantic from S.W. to N.E. for some 200 miles. Forming part of the Spanish Florida and the French "New France," it was permanently settled by the English after the Restoration, taking its name from Charles II. Along the coast the land is low and swampy, rising gradually to an elevation of 200 to 300 feet in the centre, and sloping more steeply northwards to the spurs of the Blue Ridge, where elevations of over 3,000 feet are found. The coast districts produce famous crops of rice and sea-island cotton. Cereals,

potatoes, indigo, tobacco, fruits of all kinds, and wine are largely grown on the higher levels, whilst the hilly region yields valuable timber. Water is abundantly supplied by many small rivers, the Peedee, Edisto, and Santee, with its tributaries the Wateree, the Congaree, and the Catawba being the largest. The climate is mild and healthy except in the swamps, and the tornadoes are limited in their effects to the coast districts. Numerous bays, creeks, and islets afford facilities for navigation. Columbia, the capital, is in the centre of the state; Charleston, with the largest population, stands at the head of a gulf on the banks of the Ashley river. Other towns of importance are Newberry, Georgetown, Orangeburg, Florence, Camden, and Sumter. Cotton-spinning and the making of turpentine and artificial manures are the chief industries. Gold, copper, iron, manganese, and other minerals are profitably worked, and China clay is a source of considerable wealth.

South Sea Bubble is the name given to a curious financial transaction of the 18th century. In 1710 a South Sea Company was formed to take up a national debt of £10,000,000, for which it would pay 6 per cent. interest, receiving in return a monopoly of trade with South America. The Peace of Utrecht, and the resulting conditions imposed by Spain on the trade, rendered the monopoly worthless. But in 1720 the whole country went mad on the point, and all were eager to obtain the South Sea stock at any premium. The Company now obtained leave from Parliament to take up £800,000 more, but the Bank of England entered into the competition. The South Sea Company then made more astonishing proposals, and the public enthusiasm rose still higher; but their success, which partly arose from the fact of paying interest out of capital, raised many imitators, whom the Company tried to suppress by arguments people soon recognised as applicable to the Company also. The inevitable crash came, Walpole was called in to right matters, and inquiry showed that huge sums had been spent to bribe in high places. He began by confiscating the estates of the directors, and eventually many of the victims received a dividend of $33\frac{1}{3}$ per cent.

Southcott, JOANNA (1750–1814), prophetess, was born in Devonshire, and became a Methodist. She suffered from religious mania, and in her fervour declared she was the woman referred to in Revelation xii., and was to bring forth a new Saviour, the date of her delivery being fixed for October 19th, 1814. Great preparations were made for the event by her numerous followers, but all to no purpose. Her death in December, 1814, was due to dropsy. She was believed in, however, for years after her death by some of her sectaries. She wrote several lucubrations, and issued seals which were passports to heaven and indulged rather largely in prophecy.

Southern Cross is a constellation in the southern celestial hemisphere, its declination being about 60° S., and its right ascension 180° . It consists of five principal stars arranged as a somewhat

irregular cross, and numerous smaller stars. The shape of the cross is gradually, but very slowly, changing, owing to the proper motion of the stars themselves. The cross is first seen by travellers voyaging southwards in the Atlantic when they reach the twentieth parallel, and it is as noticeable a constellation in the southern hemisphere as the Great Bear is in the northern. Its form is used as a decoration on the Brazilian stamps instead of the usual head.

Southey, ROBERT (1774–1843), Poet-Laureate, was born at Bristol, and was the son of a draper. He was chiefly educated at Westminster School, for his subsequent admission to Balliol College, Oxford, did not have much effect on his culture. He travelled abroad for a year or two, and lived in Ireland for a few months, holding an official appointment there. Finally, he settled at Keswick, in Cumberland, near Coleridge, whom he had previously met, and Wordsworth. He was at this time very well known as a poet, his *Wat Tyler* having appeared in 1794, and other works, influenced by the events of the French Revolution, such as *Joan of Arc* (1796), following rapidly. Besides a couple of collections of smaller poems, he published *Thalaba the Destroyer* in 1801, *Madoc* in 1805, *The Curse of Kehama* in 1810, and *Minor Poems* in 1815. Many of these were adversely and not unjustly criticised, and at the present day Southey is considered a better prose-writer than a poet, his *Life of Lord Nelson* (1813) being one of the finest biographies in the language. In the last-named year he was made Poet-Laureate, and in 1837 was offered, and declined, a baronetcy. He was a most voluminous writer, and a few of his lyrics are still admired. In 1839 he married his second wife, Miss Caroline Bowles, a poetess of some merit.

Southport, a municipal borough and seaside resort in Lancashire, standing between the estuaries of the Mersey and the Ribble, 18 miles N. of Liverpool. It is essentially a pleasure town of modern origin, with fine broad streets, three public parks, winter gardens containing a theatre, aquarium, skating rink, and handsome public institutions of the usual kind. It gives its name to a parliamentary division of the county.

Southwell, a market-town of Nottinghamshire, 17 miles N.E. of Nottingham, on the river Greet. It possesses a fine old collegiate-church, now a cathedral, founded in the 12th century upon the site of an older structure. There was also a palace of the Archbishops of York, and within its walls Charles I. surrendered to the Scotch Commissioners. Since 1884 it has been the seat of a bishopric. Silk-weaving gives employment to many of the inhabitants.

Southwell, ROBERT (1560–95), poet, was born in Norfolk, and, after completing his studies at Donai College, became a Jesuit at Rome. He returned to England as a missionary, and his zeal in converting was so obnoxious that he was thrown into prison in July, 1592, remaining there three years. He was finally executed at Tyburn in February, 1595, on a charge of disseminating Catholic

doctrines in England. His poems are chiefly religious, and are often excellent. *St. Peter's Complaint*, 1593, and *Mœniæ*, a collection of hymns, published in 1595, are his best-known works. His prose writings are less known, but are deserving of praise.

Souza-Bokelho, DOM JOSÉ MARIA (1758–1825), diplomatist, was of illustrious Portuguese descent, and was born at Oporto and educated at Coimbra. He entered the army in 1778, and left it in 1791, having obtained some recognition of his diplomatic abilities. He was successively minister of Portugal in Sweden, France, and England, and showed great firmness, patriotism and tact. He was an enthusiastic admirer of Camoens, and published a splendid edition of that poet's works. There was also a JEAN DE SOUZA (1730–1812), a Portuguese historian, who wrote some works on the Arabic tongue and on Portuguese history.

Sovereignty, in *politics*, is the political authority to order and direct what is to be done by each individual for the good of the state. It may be vested in one individual or in a number of individuals.

Sow-Thistle (*Sonchus*), a genus of succulent weeds belonging to the order Compositæ, with the ligulate florets and milky juice characteristic of the suborder Cichoriaceæ. The leaves are prickly and the flowers yellow.

Soyotes, an isolated Samoyede people of South Siberia near the sources of the Yenisei on both slopes of the Sayan Mountains. This region is supposed to be the original home of the Samoyedes (q.v.). In the same district are the Karagasses and other kindred tribes, who are now of Turki speech.

Spa, a health resort in the province of Liège, Belgium, picturesquely situated amidst wooded hills in the valley of the Wayai. The chalybeate springs became famous in the 16th century, and for many years a gambling establishment enhanced their attractions. The principal source is the Pouhon in the town itself, but there are several others scattered about the pleasant neighbourhood.

Spadix, a form of inflorescence characterised by a fleshy peduncle and sessile flowers. It may be simple—i.e. a spike (q.v.), as in aroids, or branched, as in some palms. The flowers on a spadix are often, but not always, unisexual, and are sometimes sunk in its fleshy surface. The spadix is generally enclosed in a large sheathing bract or *spathe* (q.v.), and is the characteristic inflorescence of a series of Nudifloral Monocotyledons, the *Spadicifloræ*. The spadix of the common lords-and-ladies (*Arum maculatum*) is somewhat exceptional in its large club-shaped starchy *appendix* beyond its flower-bearing portion.

Spain, a country which includes the greater part of the south-western peninsula of Continental Europe, the little kingdom of Portugal occupying rather less than one-seventh of the whole peninsula. The lofty ridges of the Pyrenees divide Spain from France, its other boundaries being the Atlantic, the

Mediterranean, and the Portuguese frontier. The *area* of the country is 191,360 square miles, not quite four times that of England. The *population* is about 17½ millions.

The highest summits in Spain are in the Pyrenees (over 10,000 feet) and in the Sierra Nevada in the extreme south (over 11,000 feet). The whole central portion of the country is a plateau averaging about 2,500 feet above the sea, this tableland being divided into wide valleys by the mountain ranges or "sierras" (*sierra*, "a saw," "a broken ridge of mountains or rocks"). Each valley is drained by a river the course of which is generally broken by rapids, bars of rock and gravel and other obstructions, so that even where there is a considerable volume of water the rivers are of little use for internal navigation. In some places they have been partly canalised and thus made available for traffic. The Ebro and the Jucar are the only considerable rivers flowing into the Mediterranean, all the rest having a westerly or south-westerly course to the Atlantic. The *climate* of Spain varies considerably. In the north, along the Biscay coast, it is often cold and rainy; in the south it is tropical during a great part of the year.

It has been said that "Europe ends at the Pyrenees." The saying is of course an exaggeration, but it is quite true that Spain forms in many ways a kind of borderland of Northern Africa. The mountain system of the Atlas is a continuation of that of the Spanish peninsula. The vegetation of Andalusia and of Morocco is much the same; the little monkeys of the Rock of Gibraltar are the only animals of their kind living wild outside of Africa; and, finally, there is some community of blood between the races on both sides of the Straits. The *history* of Spain is closely connected with that of Northern Africa. The question of the primitive population of the Peninsula is still a much-disputed one, the only certain point being that there was a Celtic and a pre-Celtic race in the country, the Basques of Northern Spain perhaps representing a still earlier element in its population. The first historical references to Spain tell of the trade, chiefly in metals, carried on by its southern districts with Phœnicia, Egypt, and Greece. All these three countries sent their ships to trading ports on what is now the coast of Andalusia to bring back silver, copper, and lead in exchange for their own commodities. In this connection Spain is mentioned in the Old Testament under the name of Tarshish or Tharsis. In the 3rd century B.C. the Carthaginians attempted to regularly conquer and colonise the Peninsula, and this brought them into conflict with Rome, and in the end the latter obtained dominion over the whole of Spain. The country remained a part of the Roman Empire till the barbarian inroads, and in the person of Trajan gave Rome one of its most famous soldier emperors. Latin became the language of the country. The Castilian or Spanish of to-day is a modernised

form of Latin. Among classical Latin writers not a few were natives of Spain, the list including the names of Martial, Quintilian, and the Christian poet Prudentius.

The first wave of barbarian invasion, that of the Sueves and Vandals, came over the Pyrenees in A.D. 409. Five years later they were followed by the still more formidable invasion of the Visigoths or West Goths. Before the middle of the century they had driven the Vandals into Africa and cooped up the Sueves in the hills of Galicia and Asturias, and Spain formed a part of a Gothic kingdom extending from the Loire to the Straits of Gibraltar. After the death of King Euric (484) the Gothic power north of the Pyrenees fell before the Franks, and henceforth the West Gothic kings ruled over Spain only. Teutons by race, Arians in religion,



MAP OF SPAIN.

they and their nobles were at first a foreign ruling caste, separated in many ways from sympathy with the Latinised Spaniards. But the fusion of the two races was rapidly accomplished. One great cause of dissension was removed when King Recared (586-601) abjured Arianism and gave the Catholic bishops a place at his councils. Under King Suinthila (620-631) the last garrisons of the Greek Empire were driven from the coast, and under Chindasuinth (642-652) the laws of the two races, the Teutonic and the Latin, were fused into one code.

The end of the 7th century witnessed the first raids of the Saracen fleets upon the coast, the ports of North Africa, which they had conquered, being their base of operations. A rebellious nobleman, Count Julian, invited them to invade Spain in force in 711, factions among the nobles and the fierce hostility of the Jews, whom the Goths had persecuted, giving them good prospect of finding adherents in their enterprise. They landed near Gibraltar, and met and defeated Roderic, the last Gothic king of Spain, in the great battle of Guadalete, near Cadiz, which lasted a whole week (July 19-26, 711), beginning and ending on a

Sunday. Roderic was seen no more after the fight, and his disappearance is the subject of many Spanish legends. Within ten years after the battle of Guadalete the Saracens or Moors had overrun the whole country except some of the mountainous districts of the north.

The history of Spain now runs in a divided channel. It is partly that of the Moorish kingdoms, partly that of the "Reconquest." The Moors ruled over a greater or less extent of Spain for seven centuries. The first four of these were the golden age of the Saracen power in the west. The Caliphs of Cordova were munificent patrons of learning and literature, and, if other arts were in abeyance under Moslem rule, that of architecture flourished: witness the magnificent Mosque of Cordova, erected in the 8th century (now used as the cathedral). From the Moors of Spain, Christian Europe received the Arabic numerals and the Aristotelian philosophy. Averroes, "the great commentator," was a Moor of Cordova. But the conquerors were divided among themselves. It was only for a time that they obeyed a single ruler, and their dissensions opened the way for the "Reconquest." In the highlands of the north, new Christian kingdoms had been organised as the tide of Moorish conquest ebbed before the attacks of a hardier race. The kingdoms of Asturias and Oviedo were thus founded in the 8th century, Leon and Navarre in the 10th, and Aragon and Castile in the first half of the 11th. From this period the Moorish war continued with little interruption; there were occasional truces, never a lasting peace; and though the Moslems could boast of some victories, the fortune of war declared against them in the end. Toledo, once the old Gothic capital, was recaptured in 1085; Cordova, once the seat of the western caliphate, was taken in 1236 by Ferdinand III. of Castile; Granada, the last of the Moorish kingdoms, was conquered in 1492, the long siege of its capital being the closing episode of the "Reconquest." During the long war the minor kingdoms had been one by one united into more powerful states. The marriage of Ferdinand of Aragon with Isabella of Castile in 1481, the conquest of Granada in 1492, and the expulsion of the French from Navarre in 1512 united all Spain under one central Government. The Moorish war had not yet ended when a new and wider sphere of enterprise was opened to the chivalry of Spain. It was in the camp of Santa Fé, before Granada, that Isabella granted the request of Columbus to be allowed to open a new way to the Indies as a Spanish admiral. It was in 1492, the very year of the conquest of Granada, that he discovered the New World, and the first step was taken to the foundation of the Spanish empire beyond the seas, which soon included the West Indies, Mexico, Central America, Florida and California, and all South America except Brazil. Ferdinand succeeded in making good his claim as King of Aragon to rule over Naples and Sicily, and by the marriage of his daughter to the heir of the Hapsburgs it came to pass that the grandson of Ferdinand and Isabella, Charles V., united the sceptres of Spain and of the German Empire, and thus ruled over the greater part of Europe.

The reign of Charles V. saw the power of the Crown in Spain transformed from a limited into an absolute monarchy. The cities were played off against the nobles; the wealth derived from the Indies enabled the Crown to support a strong standing army; local privileges were abridged or abolished, and the Cortes became a mere deliberative assembly, which soon was not even asked to give its formal consent to taxation; and the Inquisition was used as a kind of Star Chamber for political purposes. This was the period of the greatest power of Spain. Its decline began in the latter part of the reign of Charles's son, Philip II. (1556-1598). He succeeded in temporarily annexing Portugal to Spain; but he lost the Netherlands, where the harsh rule of Alva had provoked a revolt. The failure of the Armada crippled Spain upon the sea, and English, French, and Dutch adventurers preyed upon her commerce. By the end of the 17th century Spain had become a second-rate power in Europe.

The extinction of the direct line of the royal house on the death of Charles II. in 1700 led to rival claimants for the throne being put forward by France and the German Empire. Hence the war of the Spanish Succession (1701-13), in which all the western powers were involved either as principals or as allies. England in 1704 seized Gibraltar in the name of one of the rivals and kept it for herself. The Spaniards have never given up the hope of reconquering it, and still appoint a titular governor of the fortress, who resides at Algeciras. The war ended with the Treaty of Utrecht, which gave the throne of Spain to Philip V., of the House of Bourbon, it being stipulated that the two crowns of France and Spain should never be united on one head. During the eighteenth century the policy of Spain was in the main modelled on that of France. On several occasions the Spanish fleets and armies as the allies of the French unsuccessfully besieged Gibraltar. On the outbreak of the French Revolution Spain joined the other powers in the coalition against the Republic, but was forced to make peace. An alliance with Napoleon resulted in the Spanish fleets being destroyed by Jarvis and Nelson, and a little later French treachery obtained the abdication of the king and the occupation of the fortresses by French garrisons, and Napoleon's brother Joseph was proclaimed King of Spain. A popular rising against the invaders, and the help of the English army under Wellington, secured after a long struggle (1807-14) the expulsion of the French and the restoration of the Bourbon kings.

The reign of Ferdinand VII. (from the end of the Peninsular War to 1833) was marked at home by conflicts between the Liberal and Reactionary parties, in the course of which the king in 1823 called in the aid of a French army; and abroad, by the loss of the Spanish colonies in America, all of which except Cuba and Porto Rico drove out their Spanish Governors and declared themselves free republics. The death of Ferdinand in 1833 was followed by the first Carlist War, his brother, Don Carlos, endeavouring to obtain, in virtue of the old Salic law, the crown which Ferdinand had left to

his infant daughter, Isabella II. The Regent Queen Christina succeeded in defeating Carlos, thanks to English and French assistance. The reign of Isabella was disfigured by palace intrigues and military revolutions. It ended in 1868 by her flight in the presence of a military revolt. After two years of a provisional government, the crown was in 1870 accepted by Amadeus of Savoy. He only ruled for three years, during which he had to contend with the Carlists on the one hand and the Republicans on the other, the grandson of the first Carlos raising a formidable insurrection in the north, and the Republicans openly plotting against the foreign king. On his abdication in 1873 the Republic was proclaimed, but dissensions among its supporters and its failure to suppress the Carlist insurrection led to the recall of the Bourbons in December, 1874, in the person of Alfonso XII., the son of Isabella. In 1876 Carlos gave up the struggle in the north. Alfonso died suddenly in 1885, and Spain is now ruled by his widow, Queen Christina, acting as Regent for her son, Alfonso XIII., born in May, 1886, some months after his father's death. Under her rule Spain has made considerable progress towards stable government, but the finances are in disorder, and the existence of a strong Republican party and the rival claims of the Carlists make the outlook for the country a very anxious one.

Spain is in the main an agricultural country, but fully one-half of the country is uncultivated, and indeed much of the mountain-land is unfit for cultivation. The north and the uplands of the centre afford grazing-grounds to herds of cattle and goats, flocks of sheep and droves of swine, the rearing of bulls for the bull-ring being in some districts a very profitable business. In the south especially wine-growing is the most important industry, and the manufacture of corks is carried on in the same districts. In the towns of Catalonia, notably in Barcelona, there is a considerable cotton manufacture. The iron-mines of the north, the great copper-mines in the south (especially those of Rio Tinto), the mines of lead, silver, and quick-silver, and the salt-making industry of the coast districts, also employ a large population. But there is still great room for industrial development in Spain, and even the agriculture of the country might be greatly improved, the old wooden plough of Roman days, little better than a big forked stick, being still used on many farms.

The extensive remains of Moorish architecture give an Oriental aspect to most of the southern cities of Spain, the cathedral of Cordova, the Alcazar of Seville, and the palace of the Alhambra at Granada being the most striking examples. Christian architecture in Spain is a very ornate Gothic, of which the splendid cathedral at Burgos is the typical example. In art the most famous name in Spain is that of Velasquez. In literature the names of Cervantes, the author of *Don Quixote*, and Calderon, the dramatist, have become world-famous; but these are only two among the many names deservedly held in honour in Spain itself as poets, dramatists, historians, or romancists. Other Spanish names that have won a world-wide reputation are those of Ignatius of Loyola, the founder of

the Jesuits, and Francis Xavier, the great missionary both of them of the Basque race of the north.

Spain has fortunately for herself not been drawn into the great rivalry in military and naval armaments which is the bane of most continental nations, but she has had to expend enormous sums to defray the cost of ruinous civil wars at home, and of the suppression of formidable revolts in Cuba. A number of fortified posts on the coast of Morocco are garrisoned by Spain, which cherishes the hope of succeeding to the control of the whole country when the Moorish power finally goes to pieces. Little wars with the tribes in the neighbourhood of these places are carried on with a vigour which shows that the old spirit of the "War of the Reconquest" is not dead in Spain. It is always easy to obtain eager volunteers in Spain for a new war against the Moors. The mutual jealousy of more formidable claimants for the heritage of the Sultans of Morocco will very likely enable the Spaniards some day to enter upon the possession of this coveted prize. All that is left to Spain of her old empire is Cuba and Porto Rico in the West Indies, the Philippines in the East, the Caroline Islands in the Pacific, the Canaries in the Atlantic, and a few posts in Africa.

Spalato, a town of Dalmatia, situated on the E. side of the Adriatic, about 160 miles from Fiume. Here stood the palace of Diocletian, to which he retired after his abdication; considerable traces of it still remain.

Spalding, a market-town of Lincolnshire on the river Welland, 34 miles S.E. of Lincoln, and in the heart of the Fens. It grew up after the Conquest about a famous priory, of which no traces exist. The parish church is a fine specimen of 13th-century Gothic, and the grammar school had its source in the desecrated Lady Chapel, but is now rebuilt on another site. The town depends for its prosperity on the surrounding agricultural district.

Spandau, a fortified town in the province of Brandenburg, Prussia, 8 miles N.W. of Berlin, and at the point where the Heavel joins the Spree. It is an ancient place, and for many years served as a prison and treasury, a large gold reserve being kept there for military emergencies. The works have been greatly strengthened of late years, and large factories have been erected for guns, powder, and all the munitions of war. It was taken by the Swedes in 1635, and by the French in 1806. Baron Trenck was imprisoned here about 1760.

Spaniel, a general name for several breeds or strains of the domestic dog, agreeing in their soft silky coat and affectionate disposition, though differing much in size and appearance. They fall into three groups:—(1) Land or Field Spaniels, used chiefly to flush game. Here belong the Cocker and Springer, and from the last the Clumber, Sussex, and Norfolk Spaniels have sprung. (2) The Water Spaniels, an Irish breed, the largest of the group, with reddish-liver coat. (3) *Toys*. Of these the Blenheim Spaniel (q.v.) is a good example. The King Charles differs from it in its black-and-tan coloration.

Spanish Fly. [CANTHARIDES.]

Spar, now merely a popular term, generally applied to any translucent and distinctly crystal-line mineral, such as rock-crystal, calc-spar, fluor-spar, fel-spar, etc. In 1820 Vons Mohs attempted to use it as a classificatory term, including under it most silicates.

Sparks, JARED (1789-1866), president of Harvard University, was born in Connecticut, and was a carpenter by trade. He was enabled to study at Harvard, and was made one of its tutors in 1817. He read theology deeply, and in 1819 was ordained a Unitarian, writing several theological treatises. Retiring in 1821 from the ministry, he settled in Boston, and produced his valuable *Life of Governor Morris, Life and Writings of Washington* (1834-37), his edition of Franklin's works, and his *Correspondence of the American Revolution*. He became a professor of Harvard in 1839, and president in 1849.

Sparrow, a genus (*Passer*) of birds of the Finch family, with about thirty species, confined to the Old World. The bill is strong and sub-conical, with the nostrils at the base half-hidden by projecting and recurved frontal plumes; tail moderately long and nearly square; claws rather short and curved. The House Sparrow (*P. domesticus*) is common over the British Islands, Europe,

SPARROW (*Passer domesticus*).

and the north of Asia. The length is about six inches; the male has the mantle brown striped with black, the head bluish-grey, the cheeks greyish-white, the front of the neck black, and the under parts light-grey. On the wings are two narrow bands, one white and one rusty yellow. The female is more plainly clad. These birds are omnivorous; they do much damage to grain and fruit crops, but it is a question whether they do not more than repay the damage by the vast quantities of insect larvæ they kill for the purpose of feeding their young. Opinion is divided as to whether the sparrow should be reckoned among the farmer's friends or foes. Dr. Coues, the

American ornithologist, regards the introduction of this bird into the United States, for the purpose of destroying harmful insects, as a mistake, and speaks of it as a pest and a curse. The Tree Sparrow (*P. montanus*), with a more restricted range, differs little from the House Sparrow except in its smaller size.

Sparrow-Hawk, any bird of the Falcon genus *Accipiter*, with six species almost universally distributed. They are allied to, but smaller than, the Goshawk (q.v.). The Common Sparrow-Hawk (*A. nisus*), is about a foot long, dark-brown on the upper surface, with the under surface rusty brown barred with dark bands. The female is somewhat larger, and has the ground-tint of the under surface greyish. These birds are fairly common in Britain, though they are relentlessly persecuted by gamekeepers on account of their preying on young game birds.

Sparta, or LACEDÆMON, a cluster of villages occupying a plain on the west of the river Eurotas between the heights of Taygetus and Parnon, and almost in the centre of the Peloponnesus. The rise of this rustic city to be the head of Laconia, the supreme power of the peninsula, and the rival first of Argos and then of Athens, dates from the reforms of Lycurgus in the 9th century, but was due also to certain racial characteristics which it is impossible to trace to their source. The Spartans represented throughout history the aristocratic and agricultural interests as opposed to democracy and commerce. To push these principles she colonised, and meddled in the affairs of other states; but selfish isolation was the keynote of her policy. To secure her influence she could temporise with Persia, massacre her helots, and stamp out liberty in neighbouring states. Now and then she seemed to be inspired with national enthusiasm, but the fit was short-lived, and usually ended in petty oppression. The periods of her greatest influence were in the 6th century, when she took the lead in crushing out the popular tyrannies, in the 4th century, when Athens was ruined by the defeat at Ægospotami, and in the 3rd century, when she resisted Pyrrhus and endeavoured to form the Achæan League. Nabis, a low freebooter, then made himself master of the city of Menelaus, and Philopoemen razed the walls to the ground. In the middle of the 2nd century Rome stepped in, and a few ruins near Mistra, the present capital, are all that is left of one of the most famous of human communities.

Spartacus (113-72 B.C.), leader of the Italian gladiatorial revolt, was a Thracian by birth, and was originally a shepherd. Very little is known of his career, but it is certain that after the conquest of Macedonia he was forced to serve in the Roman army, and his size and strength was the reason of his being selected for training as a gladiator. In 72 B.C. he organised a rebellion of his fellow-slaves, and their number, originally 70, increased, it is believed, to 70,000. For a time they were brilliantly successful, but at length, after a struggle which has earned the admiration of the world, they were defeated by Crassus, and Spartacus was killed.

Spasm, the involuntary contraction of muscle. Spasm is tonic or clonic. [CONVULSION.] The ordinary "cramp" affecting the muscles of the calves of the legs is a good instance of muscular spasm. In tetany (q.v.) the spasm affects the muscles of the hands and feet. The muscles of the eyes are sometimes thrown into a condition of spasm producing deviation of the eyeballs such as occurs in the "inward fits" of children. Contraction of the muscles which close the eyelids produces what is known as blepharo-spasm. When the muscles of the mouth are affected, cynic spasm is produced. The common form of wry-neck is due to muscular spasm. Epilepsy, chorea, and tetanus are diseases in which spasm of muscles plays an essential part. Spastic paraplegia is a condition met with in a peculiar form of disease affecting the spinal cord.

Spatangoidea, an order of Sea-Urchins or Echinoidea including those in which the anal aperture opens outside of the "apical system" (q.v.), and is not on the extreme upper point of the shell or test, and which have neither external gills nor an internal series of jaws or teeth. It is divided into two sub-orders, the Cassiduloides (q.v.), and the Spatangoidea, of which the latter includes the more typical forms such as the common Heart-Urchin (*Spatangus purpureus*), the common Chalk fossils, *Micraster* and *Echinocorys*.

Spathe, a large sheathing bract (q.v.) enclosing a whole inflorescence, and occurring almost exclusively among Monocotyledons. It may be *herbaceous*, as in lords-and-ladies; *petaloid*, in texture and colour, as in the trumpet-lily (*Richardia æthiopica*); or *membranous*, as in *Narcissus* and in the palms. In the daffodil it only encloses a single flower; but in other species of *Narcissus*, such as the jonquil, as in most other cases, a number. The spathe of the date palm is commonly used in Southern Europe for packing oranges.

Spathic Iron Ores consist of the carbonate of iron in a comparatively pure state, with but little admixture of earthy matter. The carbonate of manganese is, however, frequently present, but this is not detrimental as it enhances the value of the ore for many purposes. The ore when pure forms rhombohedral crystals of a white colour, but is usually yellow or brown. The chief localities where it occurs are Durham, Somerset, and Cornwall in this country, and in Styria, Carinthia, and Prussia.

Spavin. [BOG SPAVIN.]

Speaking Trumpet is an instrument which forms, as it were, a sounding-board for the voice, and enables speech to be heard at a far greater distance than would otherwise be the case. It consists of a cone cut near its apex to form a convenient opening into which to speak. The other end is curved slightly outwards. The compressions and expansions of the air in the trumpet are protected from the effects of violent wind outside; hence the whole of the air just outside the opening is set in motion by the waves of sound. Without the trumpet the initial waves would have been

destroyed in a storm, or at any rate much weakened before they had traversed a distance equal to the length of the trumpet. It is of great use at sea in enabling orders to be heard across the ship in boisterous weather.

Spear, a generic weapon, the prototype of the whole race of throwing and stabbing weapons. The early spear consisted doubtless of wood sharpened at the end and hardened by fire. The next steps were to head it with fish-bone, flint, bone, shell, and eventually metal, the finishing touch being to poison the point. The mediæval lance was sixteen feet long. The spear has long existed side by side with the javelin, and the Matabele warrior has ancient precedent for carrying his long assegai and his stabbing assegai. In sport, the spear is still used in wild-boar hunting, and in some kinds of fishing, and in the case of whale-catching it is sometimes fired from a gun. The modern cavalry lance, from eight and a half to eleven feet long is becoming more and more popular, as the work of cavalry in war becomes restricted to reconnoitring and pursuing.

Species, the unit of classification for animals and plants—that is, a collection of individuals (or specimens) that make up a genus. So long as naturalists held the doctrine of fixity of species, there was no difficulty in framing a definition of the term, for the dictum of Linné was generally accepted that "there were as many species as the Infinite Being had created forms in the beginning." This, if true, would fix the origin of species, and from this it followed that a species was "a group of organisms, descended from a pair divinely created, possessing similar characters, and capable of reproducing organisms like themselves." Lamarck, in the early part of the 19th century, suggested that species were subjective, and not objective; but the influence of Linné prevailed, and it was not till the publication of the *Origin of Species* in 1859 that the Linnean conception was replaced by the theory of Evolution. Since that date, though the term "species" is retained as a convenient one for a group of individuals agreeing in essential characters which can be transmitted to their descendants, it is recognised that it is incapable of strict definition, and that what one naturalist would class as a species another would class as a mere variety, while a third would possibly give it generic rank. Professor E. Ray Lankester, in his article *Zoology* in the *Encyclopædia Britannica*, says that "Species, as well as genera, orders, and classes, are the subjective expressions of a vast ramifying pedigree, in which the only objective existences are individuals." The truth of this will be evident on consideration; and if proof were needed, it would be afforded by a comparison of the classifications of different naturalists, especially in those dealing with the lower forms of life. There is comparatively little difficulty in separating the larger animals into species, but the nearer one gets to the base of the genealogical tree the more hopeless does the task become of drawing with a firm hand the dividing line between *species* and *variety*, so closely do many of the forms approach their neighbours on each side.

Specific Gravity. The *absolute specific gravity* of a substance is the weight of matter contained in a unit volume of the substance. In absolute C.G.S. units this would be expressed as so many degrees per cubic centimetre, and would vary at different places on the earth's surface. In practice, however, gravitation units of force are always used, so that the absolute specific gravity is given as so many grammes per cubic centimetre, and the number expressing this is identical with that expressing the absolute density of the substance. The absolute specific gravity can also be expressed in terms of the pound, cubic foot, or other units. The *relative specific gravity* of a substance with regard to some standard substance is the ratio of the weights of equal volumes of the two substances. This is seen to be the same as the ratio between the absolute specific gravities of the substances; for let the weight of v volumes of the standard A be w_A , and that of v volumes of some other substance B be w_B . Then the specific gravity of B

relative to A is $\frac{w_B}{w_A}$, but this is the same as $\frac{w_B}{v} \div$

$\frac{w_A}{v}$, the absolute specific gravities of the two substances. It is usual to take water at 4° C. as the standard substance, and then if we use the C.G.S. system, the absolute and relative specific gravities are expressed by the same number, because the unit of weight—the gramme—is the weight of the unit volume—the cubic centimetre—of water at 4° C. [DENSITY.] But this is not the case if we take, for instance, the cubic foot as the unit volume and the pound as the unit mass, or gravitation unit of weight. One cubic foot of steel weighs 487½ lbs.; so, using these units, its absolute specific gravity would be 487.5. One cubic foot of water weighs 62½ lbs.; so its absolute specific gravity would be 62.5. The relative specific gravity of steel with regard to water would be, therefore, $\frac{487.5}{62.5} = 7.8$.

The relative specific gravity is, of course, the same whatever units we take, but in dealing with the variation of specific gravity of liquids at different temperatures it avoids much confusion to always use the absolute specific gravity in C.G.S. units, because there can be no ambiguity with regard to the temperature of the standard substance. Specific gravity of liquids may be measured by means of hydrometers (q.v.), or more accurately with pyknometers, which are various modifications of the specific gravity bottle. A usual form consists of a cylindrical bulb of thin glass with a thick glass neck of fine bore. The top of the neck is expanded and fitted with a well-ground stopper, while upon the neck is etched a fine scale. Preliminary experiments give the volumes of the bulb and neck up to each mark, so that all that need be done in determining the specific gravity of any liquid is to weigh the bottle when empty and when containing the liquid. The difference in the two weights gives the weight of the liquid; its volume is seen at once, and division of the weight by the volume gives the absolute specific gravity. Special apparatus is

used for the determination of the specific gravity of gases. [VAPOUR DENSITY.]

Spectacled Bear (*Ursus ornatus*), a small bear, from the Peruvian Andes. The fur is black, and there is a light-coloured ring round each eye.

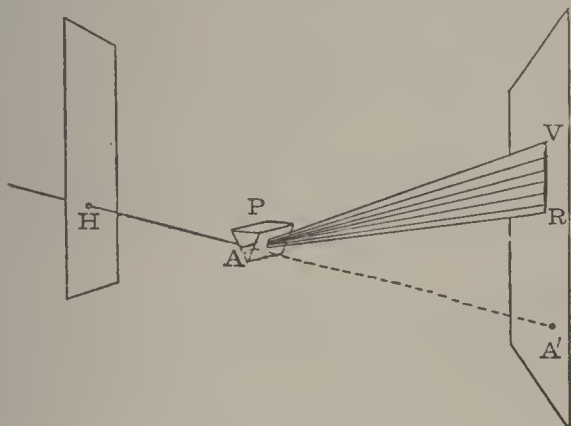
Spectacles are lenses or other refracting objects used for aiding the sight when the eyes are defective. Spectacles of convex lenses are supposed to have been invented about the end of the 13th century, and are used by long-sighted people. These produce a virtual image of the object farther away than the object from the eye, and hence at a more convenient distance for a long-sighted person. Concave lenses were used soon after the others in spectacles for short-sighted people, an image being produced nearer than the object to the person. These are the commonest forms of spectacles; but other kinds are used in certain cases—e.g. prisms are employed in some cases of squinting, and cylindrical lenses are used to remedy astigmatism (q.v.). It was formerly the rule to number lenses according to their focal lengths given in inches, but the system was not convenient, especially as the inch is not a universal unit. A more scientific system is one in which

$\frac{1}{\text{focal length}}$ is taken as the number; this has been named a “dioptric,” when the metre is the unit of length. The number of dioptries, therefore, varies directly with the refractive power or strength of the lens.

Spectroscope. [SPECTRUM.]

Spectrum. Light, coming from any source, can by suitable means be split up into its component parts. This was first discovered by Newton, who allowed a fine beam of sunlight to enter a dark room through a small hole in the shutter. If allowed to fall unmolested upon a screen, an image of the sun was formed there, but when a prism was placed in its path, instead of a round image of the sun, there appeared a brilliantly coloured band upon the screen. In the accompanying figure H A is the beam of sunlight entering at H, and tending to form the sun's image at A¹. The prism, however, affects the beam at A, and V R is the long band of colour formed on the screen. This coloured band was called by Newton a *spectrum*, and the colours vary gradually from violet (V) through indigo, blue, green, yellow, and orange to red (R). It is noticed that the violet ray is bent most away from the original direction, H A A¹, of the beam. Hence the waves of violet light are said to be the most refrangible and those of red light the least refrangible of the visible spectrum. However, our eyes are by no means able to detect the whole of solar radiation. Beyond the violet end of the spectrum there are waves capable of promoting active chemical decomposition, and this is specially the case with regard to silver salts. The presence of these ultra-violet waves can be shown in another way. Their rate of vibration is extremely rapid, but, if they fall upon some substances such as fluorescein or quinine sulphate, they produce *slower* vibrations in these bodies, and hence the eye is able

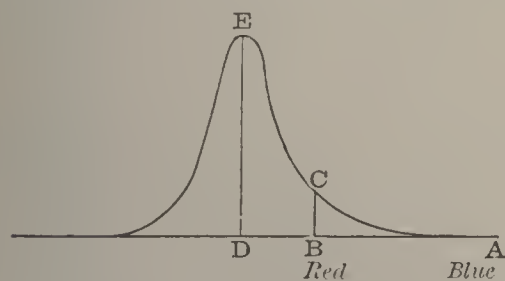
to detect them. Bodies which possess this power are said to be fluorescent, and Professor Dewar has quite recently shown that many bodies, which are not fluorescent at ordinary temperatures, become brilliantly so when extremely cold, at about -180°C . If, therefore, we let the spectrum fall, not upon a white screen, but upon one painted with quinine sulphate, we shall see the screen rendered



SPECTRUM (Fig. 1).

luminous where it was originally dark beyond the violet end. Just as there are vibrations of too frequent periods to be detected by the eye, so also are there waves whose vibrations are too slow, and these occur beyond the red end of the spectrum. We constantly experience the fact that heat and light are in the habit of accompanying each other, and, if we examine different parts of the spectrum with a sensitive thermometer, we find the temperature low at the violet end, but rising in the red part, and continuing to rise rapidly in the invisible region beyond the red, until a maximum temperature is reached, after which it rapidly falls. The accompanying figure (Fig. 2) exhibits this alteration in temperature. A B is the length of the visible spectrum, and the height of the curve above this line represents the heat at each point. Thus, B C is proportional to the temperature at B, the end of red spectrum, and D E is the maximum temperature at some point, D, in the ultra-red part. Every substance does not behave in the same manner to different radiations; by passing the light through a cell containing a solution of alum we can stop all the heat and let only the light through; by using a solution of iodine in carbon bisulphide we can

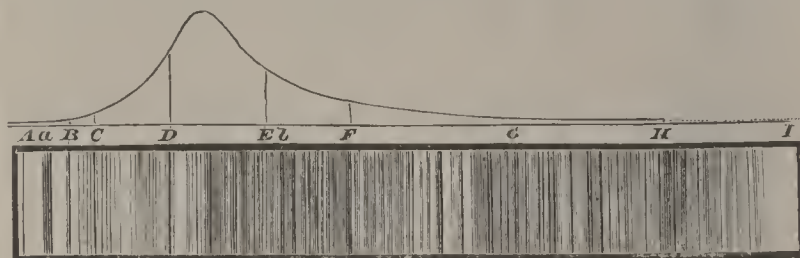
get rid of the light and leave the radiant heat invisible to our eyes, but capable of all the heating effects possessed by the original beam. Instead of using sunlight for ob-



SPECTRUM (Fig. 2).

taining a spectrum, it is generally more convenient to use artificial light. If, however, we examine the light of an incandescent vapour, we find that we do not obtain a complete spectrum. A strong electric current is capable of heating silver to such an extent that it boils; its vapour is

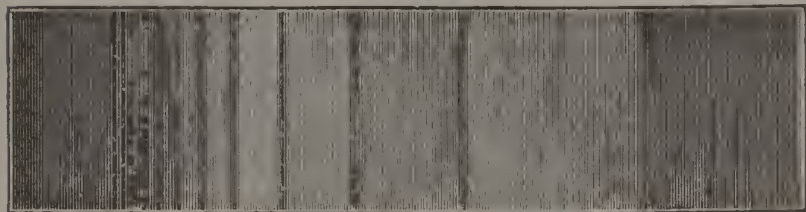
then seen to be green in colour; and, if this light be sent through a prism, its spectrum simply consists of two green bands. Zinc, treated in a similar way, gives bands in the red and blue parts of the spectrum, but only darkness exists where the other colours might be. What is true of silver or zinc applies to every other metal; the heated vapour of each gives rise to its own particular bands and no others, and the bands are never the same for any two metals. Further, these bands are given when the metal is present in any form whatever. Sodium concealed in common salt, or copper hidden in brass, give their definite and unmistakable bands. An optical examination of the incandescent vapour of a substance must therefore prove the presence of any metal which it contains. This method of examination was first used by Bunsen and Kirchhoff, and is known as *Spectrum Analysis*. The metals Cæsium and Rubidium were discovered in this way, for the substance containing them was found to give bands which did not agree with those obtainable from any known metal. Examination of substances in this way is usually performed by means of an instrument known as a *spectroscope*. In this instrument the only light which can reach the observer comes through a



SPECTRUM (Fig. 3).

very fine slit at the end of a tube. The fineness of the slit is necessary to obtain a *pure* spectrum—*i.e.* one in which there is no overlapping of the different colours. In this tube is placed a convex lens, called a *collimator*, at a distance of its focal length from the slit. Light from the slit is therefore rendered parallel by the lens, and falls upon a prism suitably adjusted in position. For actually observing the effects a telescope is used. Now, so long as we are dealing with the light of an incandescent *solid*, we shall observe a continuous and pure spectrum. With an incandescent vapour containing no solid particles we have independent bright bands. But it was for long observed that a pure spectrum of the sun exhibited a number of dark lines interrupting the range of colours. A few of these were first noted by Wollaston, but many more were found by Fraunhofer, who characterised their positions; they are hence known as *Fraunhofer's lines* (Fig. 3), and called by the letters which he gave to them. The explanation of these lines is due to Kirchhoff. It had been noted by Fraunhofer that the dark lines D of the solar spectrum coincided exactly in position with the bright lines given by the yellow incandescent vapour obtained by burning alcohol containing salt. Kirchhoff obtained a weak solar spectrum with its characteristic D lines; on making the light pass through the salt flame, however, he got two bright lines instead—the bright

lines of sodium ; he then increased the intensity of his solar spectrum, still passing the light through the



SPECTRUM OF ALPHA LYRÆ.

salt flame, and, as he did so, the bright D lines gradually faded away until at last they appeared much darker than when given by the solar light alone. Kirchhoff now obtained a pure spectrum by means of a limelight, passed the light through the salt flame, and got his spectrum interrupted by two



SPECTRUM OF SIRIUS COMPARED WITH IRON LINES.

dark lines, corresponding exactly with the D lines of the solar spectrum. It was, therefore, the case that the salt flame picked out from the complete spectrum just those waves which were the ones it could itself actually emit. It absorbed the rays which it would radiate. In the case of the experiment with the feeble solar light, when the D lines appeared rather bright the radiation by the salt flame exceeded its absorption of the same light. But as the solar light increased, the absorption rose until it exceeded the radiation, and thus by contact with the increased brilliancy of the other part of the spectrum those bands appeared dark. Many other flames were then employed to artificially produce different Fraunhofer lines, and the mystery of their existence was cleared up. This discovery immediately opened up a wide field in astronomical investigation. The presence of the D lines proves that sodium exists in the vapour surrounding the sun, while the other lines also point to the presence of definite substances, such as iron, copper,

nickel, etc., in a state of vapour. The same process of examination applied to the light from different stars has given us enormously increased knowledge of their composition.

Spectrum Analysis. [SPECTRUM.]

Specular Iron Ore, a crystallised variety of hæmatite or ferric oxide (Fe_2O_3), occurring in hard brilliant crystals belonging to the Hexagonal system. The locality where the finest specimens occur is the island of Elba, while crystals are also found in certain South American ore deposits.

Speculum Metal is an alloy consisting usually of about 32 parts of copper to 15 of tin, sometimes containing small quantities of lead, antimony, or

arsenic. It is specially used for making the mirrors of reflecting telescopes, since it is capable of taking a high polish.

Spedding, JAMES (1810-81), philosophical writer, graduated at Cambridge in 1831, and was a profound student of English philosophy. He was especially a great admirer of Bacon, and his edition of that philosopher, undertaken in conjunction with M. and R. L. Ellis and Mr. D. D. Heath, is a monumental work. The first of its seven volumes appeared in 1857, and they were followed by his notable *Life and Letters of Bacon*. Among his other works may be mentioned a very keen criticism of the methods of publishing, which appeared in 1867 with the title of *Publishers and Authors*.

Speedwell, the popular name for the pretty species of the scrophulariaceous genus *Veronica*. It includes undershrubs, several of which are grown in our greenhouses ; but the British species, 15 or 16 in number, are all herbs. Their leaves are generally opposite, and the flowers are in spikes or racemes. They are monosymmetric, the calyx being apparently four-lobed from the fusion of two sepals, and the corolla similarly apparently tetramerous and sub-rotate. The flowers are blue, white, or purple. There are only two stamens, an exceptional characteristic, and the two carpels form a flattened capsule. *V. Chamædrys*, the germander speedwell, is one of the beauties of our spring hedge-rows ; and *V. spicata* and others are common in our gardens.

Speise is an artificial compound of nickel and arsenic which is obtained by the fusion in presence of arsenic of slags and other compounds containing nickel. This is then very largely used, in conjunction with the natural ores of nickel, as one of the most important sources of the metal.

Speke, JAMES HANNING (1827-64), African explorer, was born in Somersetshire, and became a soldier, serving in India for some years. He joined the 1854 expedition led by Captain Burton into the Harar and Somali regions, and three years later accompanied Burton in the attempt to discover the sources of the Nile. Burton discovered Lake Tanganyika, and, whilst he was detained by illness, Speke proceeded and found the Victoria Nyanza, the undoubted source. He published a description of his discovery in 1863, and died the year after from the accidental discharge of his gun.

Spelling, the art of correctly writing words, has of late become the cause of much controversy. English seems to be the only language that presents the great anomaly of possessing a spelling that in many cases affords no clue to the sound of the word represented. Accordingly many have advocated the introduction of phonetic spelling, in which the sound of the word should be exactly represented, and point out that this system is to some extent adopted in shorthand. To this proposal it is objected, (1) that no logical system of phonetic spelling has yet been adopted, and (2) that such spelling would often destroy the history

of a word. Against this it is urged that sound is the best clue to derivation, and that our present system obscures, rather than reveals, derivation. On the whole, it seems a question of æsthetics. Phonetic spelling has an uncouth appearance.

Spelter, a commercial name applied to the metal zinc (q.v.).

Spence, JOSEPH (1698-1768), miscellaneous writer, was educated at Oxford, of which he became a fellow and professor of poetry. After his ordination he devoted himself to literature and produced some very creditable works. His chief work was considered to be his *Polymetis: or, an Inquiry into the Agreement between the Works of the Roman Poets and the Remains of Ancient Artists*, but his acquaintance with the leading men and women of the time resulted in his collection of *Anecdotes*, a compilation which has proved very useful to literary students and has preserved his name.

Spencer, HERBERT (b. 1820), metaphysician, was born at Derby, his father being a tutor in that town. It was from his father and his uncle, a clergyman, that he chiefly received his education. When seventeen years old he was apprenticed to a civil engineer, and followed the profession for about eight years, writing articles on various subjects connected with it for an engineering journal. His first work of a general character was a series of letters on *The Proper Sphere of Government* published in 1842. Coming to London, he became sub-editor of *The Economist*, and while holding that post published *Social Statics*, parts of which he has since formally withdrawn. Meanwhile, he wrote very frequently for the reviews, and in 1855 brought out his important *Principles of Psychology*, which partly anticipated the Darwinian theory. In this work he laid it down that all phenomena could be explained by the evolution law, and in 1860 issued the synopsis of his *System of Synthetic Philosophy*, which attracted great attention in England and throughout Europe and gave him a prominent place among modern philosophers. In 1861 appeared his acute study of *Education*, which has been translated into many languages, and this was followed by his *Essays, Scientific, Political, and Speculative* (1858-63), *The Classification of the Sciences* (1864), and *The Study of Sociology* (1873). He was engaged during this period on the realisation of his great system of philosophy, and had published the following portions of his plan: *First Principles* (1862), *The Principles of Biology* (1864), and *The Principles of Psychology* (1872). Since then he has brought out further instalments, such as *The Principles of Sociology* (1876), *Ceremonial Institutions* (1879), *Political Institutions* (1882), *Ecclesiastical Institutions* (1885), and *The Data of Ethics*. In 1881 he announced that, having expended some thousands of pounds in the publication of his *Descriptive Sociology*, he had decided to discontinue it. Whether the great work to which he has devoted most of his life will ever be completed by him is very doubtful, as he suffers from chronic ill-health. His

works have been widely translated, and their author has been offered many academic honours, which he has always declined.

Spener, PHILIPP JACOB (1635-1705), founder of the sect of Pietists, was born in Alsace, and, after leaving Strasburg University, became public preacher of the city. In 1664 he received the degree of D.D., and, going to Frankfort, obtained a high ministerial position there. In 1670 he began the series of meetings of a religious character to which he gave the name of *Collegia Pietatis*, and from this the name of Pietist arose. He visited Dresden, where he was made Court preacher, and Berlin, but Halle became the real centre of the Pietistic movement. His earnestness and knowledge obtained for him almost universal respect, and he wrote many theological works, besides several on heraldry, and was the first person to introduce the study of heraldry into Germany.

Spenser, EDMUND, was born in 1552 in London. Of his family little is known, except that it claimed relationship with the Spencers of Althorp. He was educated at the Merchant Taylors' School, and in 1569 he made his first appearance as a poet with some translations from Du Bellay and Petrarch, which were published in Vander Noodt's *Theatre for Worldlings*. In the same year he was admitted as a sizar to Pembroke Hall, Cambridge. He took the degree of B.A. in 1572, and M.A. in 1576. Of his career at college we hear nothing, except that his health was delicate, and that he became a close friend of one of the fellows of Pembroke, Gabriel Harvey, the "Hobbinol" of his pastoral poems, who attempted to bring him into a movement for the introduction of unrhymed classical metres into English verse. On leaving Cambridge Spenser lived for a while in the north of England, perhaps in Lancashire, where he probably had relations. About this time he fell in love, seriously and unhappily, with a young lady, whose name is only known in his anagram, *Rosalind*. On his return to the south he was introduced by Harvey to Sir Philip Sidney, who, in turn, presented him to the Queen, and ever afterwards exercised a strong influence over him, leading him, perhaps, into affectations of language and metre, but showing him a living example of his ideal knight and courtier. In 1579 Spenser first proved his power by the publication of *The Shepherd's Calendar*, a pastoral poem, or set of "Æglogues" (eclogues) following the classical models. The book was not printed in the author's name, but introduced as the work of a "New Poete" in a preface by his college friend Edward Kirke. In 1580, as secretary to the Lord-Deputy, he accompanied Lord Grey of Wilton to Ireland, a country which was thenceforward to be his home, and which, with its scenes of revolt and violence, must have been full of suggestions for the poet of the *Faërie Queene*, a specimen of which had already been submitted to Harvey, who greatly preferred the *Nine Comedies*, which Spenser had also sent to him, and which, with his *Stemmata Dudleiana* and other poems, are now lost. In Lord Grey Spenser had a chief whom he thoroughly admired, and whom he introduced into the *Faërie*

Queene as Arthegal, the personification of justice. His own policy, based, like Lord Grey's, on ruthless military repression, was developed in his *View of the Present State of Ireland*, which, though not published in his lifetime, was entered at Stationers' Hall in 1598. His promotion under Government was neither great nor rapid. In 1583 he was made Clerk of Decrees and Recognisances in the Irish Court of Chancery, and received a lease of the lands and abbey of Enniscorthy. In 1586 he was appointed clerk to the Council of Munster, and, perhaps in the same year, had assigned to him the castle of Kilcolman in the county of Cork. At the end of 1589 he went with Sir Walter Raleigh, now his neighbour in Ireland, to London, carrying with him the first three books of the *Faërie Queene*, which were published early in 1590. He remained in London for twelve months, and received a pension of £50 a year from the Queen. In 1591 his publisher brought out a volume of his collected pieces, *Complaints*, and in the next year he wrote *Colin Clout's Come Home Again*, and *Daphnida*. He married, in 1594, a lady whose Christian name, Elizabeth, alone has come down to us, and in the next year he published his *Amoretti* and *Epithalamion* in her honour. In 1596 he brought out three more books of the *Faërie Queene*, *Four Hymns*, *Prothalamion* and *Astrophel*. In 1598 he was appointed Sheriff of Cork, but in the same year his house was burnt down during Tyrone's rebellion. He crossed to England, ruined, and died at Westminster on the 16th of January, 1599. He was buried in the Abbey near Chaucer, whose English he had imitated, and as whose first great successor, alike in melody and creative power, he is admitted to rank.

Spermaceti is a shining waxy solid which is obtained from the oil which occurs in certain parts of the White or Sperm Whale. The oil is found chiefly in a cavity situated in the upper jaw, and is usually removed by an aperture cut just alongside the nose, being obtained in very large quantities. On standing and cooling, the oil (sperm oil) deposits crystals of the spermaceti, which are purified by pressure and recrystallisation. Chemically, the substance consists chiefly of *cetyl palmitate* ($C_{32}H_{64}O_2$), and, if pure, forms waxy flakes or needles, which melt at 49° . The oil is of a yellow colour, with a slight odour, and is used for illumination and for soap-making. Spermaceti is not now much used medicinally, but an ointment is prepared from it, with Chinese wax and alcohol.

Spermaphytes. [PHANEROGAMIA.]

Sperm Oil. [SPERMACETI.]

Sperm Whale, or CACHALOT (*Physeter macrocephalus*), the sole species of a genus of Toothed Whales, from tropical and sub-tropical seas, where they occur in large schools led by old males. The length of the male, when full grown, is about 60 feet, of which the enormous square head counts for a full third; the females are much smaller. The colour is black above, lighter on the sides, and silvery-grey beneath. There are no teeth in the

upper jaw, and those in the lower jaw fit into hollows above. They feed principally upon cuttle-fish and squids, and are hunted for their oil, spermaceti, and ambergris.

Spezzia, or SPEZIA, a port in Italy, situated on the gulf of the same name, 56 miles S.E. of Genoa. It is now the great naval arsenal of the kingdom, the harbour having been recently protected by an immense breakwater, whilst docks and basins have been constructed with an area of 250 acres. The military depôts are in the suburb of St. Vito, whilst the naval yards lie at St. Bartolomeo across the gulf.

Sphagnum. [BOG-MOSS.]

Sphenodon (*Hatteria punctata*), a New Zealand lizard, the sole living representative of the order Rhynchocephalia, but rapidly becoming extinct. In form it is not unlike an iguana; the upper surface is olive-green with yellow spots, the under surface is whitish. The greatest length is about two feet, but those brought to Europe are smaller. The skeleton is in some respects fish-like, and in others crocodilian. The chief interest of the animal lies in the fact that it was the subject of W. B. Spencer's investigation of the median eye, which Von Graaf had found in the slowworm. Further investigations seem to point to the conclusion that the pineal body of the brain is in reality a vestige of an impaired median eye that looked upward. Similar eye-like structures have been found in other lizards and in some fishes. (Spencer's Papers on the subject will be found in *Proc. Roy. Soc.* 1886, p. 559, and *Quar. Jour. Micros. Science*, xxvii, 165.)

Sphenoid Bone. [SKULL.]

Sphere is the most regular and symmetrical solid figure. It is produced by the revolution of a semicircle about its diameter, and every point on its surface is equidistant from its centre. Every plane cuts the sphere in a circle; if the plane passes through the centre, the circle is called a great circle, other circles being called small circles. All great circles are equal. Two spheres always intersect in a circle, whose plane is perpendicular to the line joining the centre of the spheres. The surface of a sphere is equal to $4\pi r^2$, where r is its radius, and is equal to $\frac{2}{3}$ the total surface of the circumscribing cylinder. This cylinder is one whose length and the diameter of whose ends are equal to the diameter of the sphere. Its centre therefore coincides with the centre of the sphere, and the latter is just contained in it. If we regard only the curved surface of the cylinder and not the ends, we note that the surface of sphere and cylinder are equal; also, if we take a section of the sphere parallel to the base of the cylinder, the curved surface of the portion of the sphere so cut off is equal to that of the cylinder. But the area of the curved surface of the cylinder equals the circumference of its base (which is the same as that of a great circle of the sphere) multiplied by its height; hence this is the area of the section of the

sphere's surface. Extending this slightly, we see that if a sphere be cut by two parallel planes, the area of the curved surface so obtained is equal to the distance between two planes multiplied by the circumference of a great circle. The volume of a sphere is $\frac{4}{3}\pi r^3$, or $\frac{2}{3}$ the volume of the circumscribing cylinder.

Spheroid is a limiting case of the ellipsoid when the sections in one direction are circles instead of ellipses. It can be obtained by the revolution of an ellipse about one of its axes. If the major axis be taken as the axis of revolution, a prolate spheroid is obtained, while revolutions about the minor axis give an oblate spheroid. The earth is an example of the latter. As major and minor axes approach each other more and more in length, the two ellipsoids also become more alike, the limiting case being the sphere. [ELLIPSOID, QUADRIC SURFACE.]

Spherometer consists of a circular disc of metal with a graduated edge. This rests upon three equal equidistant legs whose points are hard and rounded. A screw is fixed to the centre of the disc, and its end is also hard and rounded. When the spherometer rests upon a plane—say, a smooth sheet of brass—it is perfectly steady on its three feet; but the disc may be turned till the fourth foot also meets the glass. At one point all four feet are in a plane, but another fraction of a turn brings the fourth foot too far down, and the whole instrument rocks. The point when rocking is just about to commence is the point when the fourth foot is exactly level with the other three. If the instrument be now transferred to a lens, the central foot must be screwed up to let the three feet take a steady position, and then screwed down till rocking is again just about to commence. The distance through which the foot has been moved since it was on the flat plate is read off on a fixed upright scale, and fractions of a revolution are obtained by observing the position of the graduated disc. The curvature of the lens can then be quite simply deduced.

Sphincter Muscle, a muscle which regulates the closure of an orifice in the animal body, *e.g.* the sphincter of the urinary bladder and the sphincter ani.

Sphinx ("THE STRANGLER") is met with in Egyptian and in Greek mythology, though it is doubtful if there is more than an accidental connection between the two. The Greek Sphinx has the body of a lion, the face and bust of a woman, and is winged. The story goes that the Sphinx haunted Bœotia and tormented people with the conundrum, "What goes on four legs in the morning, two at noon, three at night?" Œdipus solved it, thereby bringing woe upon himself, and the Sphinx, having no further object in life, killed herself. The Egyptian Sphinx is not winged, has a human head, male or female, surmounted by an Egyptian head-dress, and a lion's body. Its Egyptian name is equivalent to "lord" or "master." These figures were often used at the entries of temples. The well-known Sphinx at Gizeh is 150

feet long and 63 feet high. The Louvre possesses one of red granite 22 feet long.

Sphinx, a genus of moths which is the type of the family *Sphingidæ* and the section of *Sphinges*. The typical species of the genus is *Sphinx ligustri* (Linn.) or the Common Privet Hawk Moth, so named as the larva feeds on the privet, ash, etc. *Sphinx melleni* is a fossil species from the Solenhofen Slate in the Jurassic system in Germany.

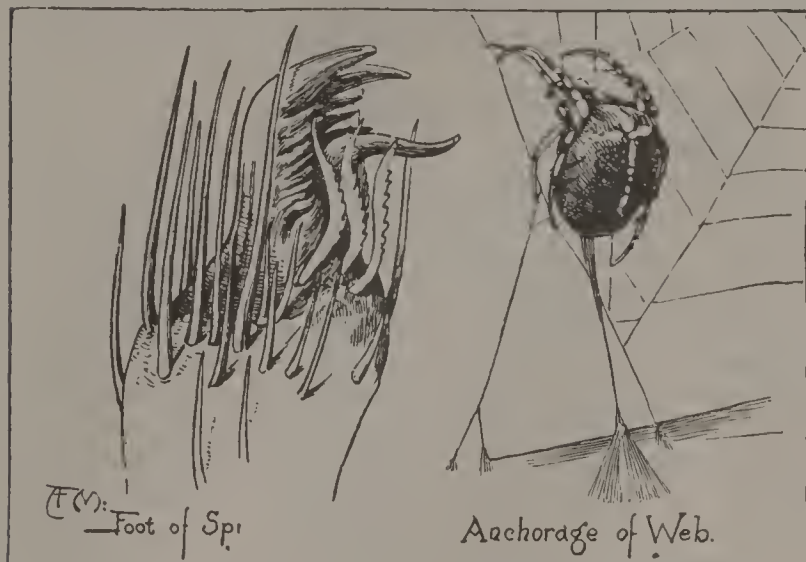
Sphygmograph. [PULSE.]

Spicules, small and typically needle-shaped structures which form the elements of the skeleton in many invertebrates. They are composed of different materials, such as carbonate of lime in the Gorgonias, silica in the siliceous sponges, or chitinous or fibrous material, as in freshwater sponges. They occur in many different groups, including the sponges, echinoderms, alcyonarians, corals, tunicates, and bryozoa. They may be united together to form regular lattice-like skeletons, as in the Hexactinellid Sponges, or into dense masses with the spicular structure obliterated, as in *Corallium*, the Red Coral, or may be loosely scattered through the soft fibres, as in the outer crust of Gorgonias and in horny sponges.

Spider-Monkey, a popular name for any species of the genus *Ateles*, New World monkeys, from Central and South America. The thumb is absent or rudimentary. They are arboreal in habit, and have long limbs and a prehensile tail. The name is said to have been given by some Europeans, who likened them to gigantic spiders.

Spiders, the members of the group of Arachnida (q.v.) known as the Araneidæ. They are characterised by having a soft, unsegmented abdomen, a pair of powerful jaws or "feelers," perforated by the ducts from a poison gland, and by the possession of two or three pairs of spinnerets or spinning organs. They breathe by means of one or two pairs of lung sacs. The character which is most conspicuous on casual examination is that the two front of the three segments, into which the bodies of the Arachnida are typically divided, are fused together into a single mass or cephalothorax; the abdomen is connected to this by a short, narrow stalk or peduncle. The spiders are mainly terrestrial, and therefore breathe air; this passes through small openings known as stigmata on the lower surface of the body. The stigmata are usually two in number, but four are not uncommon (*e.g.* *Mygalidæ*), while in others there may be one or more additional ones in front of the spinnerets. The stigmata lead into either lung sacs or branching tubes known as "tracheæ." The first pair of stigmata always open to lung sacs; the second pair either to lung sacs or tracheæ; and the additional posterior stigmata are always connected with tracheæ. Some spiders are aquatic, but, nevertheless, they breathe air which they carry down to their nests in bubbles attached to the hairy portions of their body. The eyes are always simple; the number varies from one to four pairs; they are arranged in a group or in lines on the top of the

front portion of the cephalothorax. As would be inferred from their possession of powerful piercing jaws and poison glands, the spiders are carnivorous in habit. The method by which they catch their prey is the feature of most general interest in this group. In the hinder part of the abdomen there are many small glands which secrete a viscid fluid, which, on exposure to air, hardens into a thread.



The glands communicate by ducts with pores on the summits of four or six small tubercles known as spinnerets; the secretion is forced through these, and comes out as a fine thread. This is used either (1) to attach the eggs to the body of the parent, or (2) to form nests or cocoons in which the eggs are stored, or (3) usually for the spinning of a web in which the food of the spider is entangled. The form of the web is very varied; in the common garden spiders it consists of radial spokes connected by cross threads, and is generally circular in shape; in others it is a thin, irregular sheet; in others, common on grass, it consists of a thin tube often placed in the centre of a funnel-shaped sheet; and in others it is a buried tube, the mouth of which is closed by a door, as in the "Trap-Door Spiders." In some of the larger spiders no web is made, but the animal hunts its prey. The spiders are bisexual, and the males are much smaller than the females, but usually more active. In some cases this "sexual dimorphism" is carried to an extreme, and the male exists only in order to fertilise the female. The female, in some of these, often devours the male either during the flirtation or as a post-nuptial settlement after copulation. The oldest spiders occur in the Carboniferous rocks; a few have been found in the Jurassic, but most of the fossil species have been yielded by the amber deposits in the Oligocene of North Germany. The "Sea Spiders" and "Harvest Spiders" do not belong to the Araneida, and are not true spiders; the former are members of the Pycnogonida (q.v.), and the latter of the Phalangida (q.v.).

Spiegeleisen, a variety of cast-iron which contains a very high percentage of carbon, sometimes 5 per cent. It also always contains manganese to the extent of 5 per cent., and frequently much more. Owing to this constituent, it is much used for the production of steel by the Bessemer process, as, although but little of the

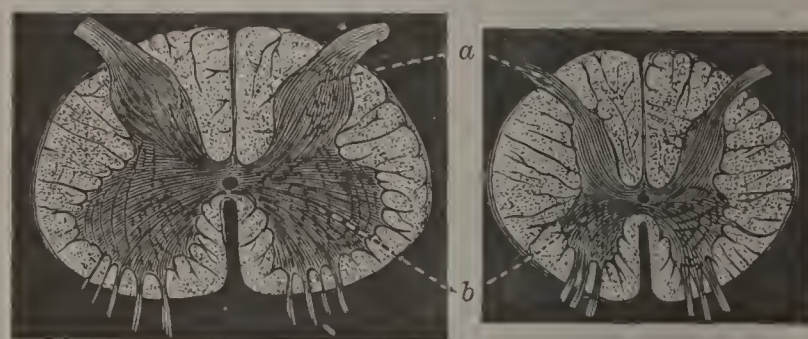
manganese passes into the steel, yet it materially improves the quality of the product.

Spike, a form of inflorescence in which the peduncle is elongated, the flowers are sessile, and the order of opening is acropetal. A *compound spike* occurs in wheat, its small component spikes being termed *spikelets*. The spikelets in other grasses are variously arranged. A *simple spike* occurs in the plantains. The *catkin* differs mainly in being deciduous; the *spadix* (q.v.) in having a fleshy peduncle.

Spikenard, the aromatic bitter root of *Nardostachys Jatamansi*, a Nepalese herbaceous plant belonging to the Valerian family. It is largely used in Indian perfumery.

Spinach (*Spinacia oleracea*), a hardy annual, probably native to Western Asia, belonging to the order Chenopodiaceæ, which has been cultivated in England for more than three centuries for the sake of its large, succulent, triangular leaves, which form an esteemed vegetable. They are rich in nitre. *Tetragonia expansa*, the New Zealand Spinach, wild in Japan and in most of the southern hemisphere, was introduced by Banks in 1772, and is used as a summer spinach. The leaves of some small varieties of beet (*Beta vulgaris*) are also employed as a substitute, and the young tops of the stinging nettle are similar in flavour. Mountain Spinach or orache (*Atriplex hortensis*), a native of Tartary, formerly much grown in England, is still cultivated in France.

Spinal Cord. The spinal cord is a cylinder of soft nervous tissue which extends from the medulla oblongata to the first lumbar vertebra, being contained in the spinal canal of the vertebral column. It is ensheathed in membranous structures, the attachments of which serve to maintain it in position, and from its lower extremity a narrow

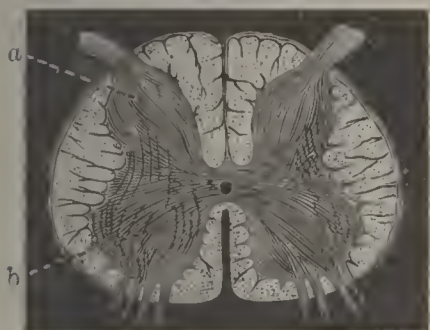


SPINAL CORD.

1. Transverse section through the Cervical region.
 2. " " " " " Dorsal region.
- a, posterior horn; b, anterior horn.

cord, the *filum terminale*, depends. The spinal cord gives off 31 pairs of nerves [NERVE], and it is bulged in the situations from which the nerves which form the brachial and lumbar plexuses emanate; these points of swelling are spoken of as the cervical and lumbar enlargements. The cord consists of two lateral halves, which are almost completely separated from one another by the anterior and posterior median fissures; the former of these is an actual cleft; the latter is constituted by a penetration into the substance of the cord of

a partition formed by one of the enveloping membranes, the pia mater. The cord consists of white and grey matter, the former constituting the outer part of the cord, the latter lying internally and being disposed in a shape which has been compared to that of the letter **H**. The grey matter thus consists of two lateral halves united by a median band, in the centre of which is situated the central



SPINAL CORD.

Transverse section through the Lumbar region.

a, posterior horn.
b, anterior horn.

canal of the cord. That portion of the median band which lies in front of the central canal is called the anterior commissure, and that portion which lies behind it is called the posterior commissure. The extremities of each lateral arm of the grey matter are called horns, anterior and posterior respectively.

The anterior horn presents a rounded bulbous enlargement, from which a number of strands of nerve fibres pass outwards at certain points and form the anterior roots of each of the spinal nerves; many of these nerve-fibres communicate with the large ganglionic nerve-cells, which are disposed in a number of more or less definitely localised clusters in the anterior horn of the grey matter of the cord. The posterior horns are prolonged outwards in the form of strands of nerve fibres which pass into the posterior roots of the several spinal nerves. By the emergence of nerve fibres from the grey matter of the cord to form the roots of the spinal nerves, the white matter lying superficially to the central core of grey matter is split up into three columns, anterior, lateral, and posterior, as they are termed. Examined microscopically, the grey matter consists of nerve-cells, nerve-fibres, and a network (neuroglia); it is richly supplied with blood-vessels. The white matter contains a supporting framework of neuroglia, but is mainly composed of white medullated nerve fibres, which are disposed longitudinally in the substance of the cord. An account of the connections which are established by these columns of white fibres and of their association with the transmission of motor impulses is given under the heading PARALYSIS. The motor impulses, after passing downwards in the "motor path" [PARALYSIS], emerge from the cord along the anterior roots of the spinal nerves. The posterior roots are largely concerned with the transmission of sensory impulses, which reach them after travelling from the periphery along the nerve trunks, and are conveyed through the posterior roots to the grey matter of the cord.

Diseases of the Spinal Cord. When disease affects the spinal cord, it is apt to be limited to certain regions, and in association with the locality involved special symptoms occur. In the disease known as infantile spinal paralysis, the ganglion cells in the anterior horns of the grey matter are particularly affected. Certain degenerations

involve particular longitudinally-disposed strands of white matter; for instance, in locomotor ataxia (q.v.) the posterior columns of the cord are specially implicated in the degenerative process. Degeneration of parts of the lateral columns of the cord occurs in association with affection of those portions of the anterior columns which adjoin the anterior median fissure. Such degeneration is often spoken of as "descending degeneration," as it usually progresses from above downwards, and is attributable to disease affecting some portion of the motor tract, and the nerve-fibres, which travel along the cord in the situations indicated, are thus cut off from their normal connection with the upper parts of the system of nervous structures, and therefore undergo degenerative change. [PARALYSIS.] The membranes of the cord are sometimes affected by inflammation (spinal meningitis), and a diffuse inflammation of the substance of the cord (myelitis) is in rare instances met with. [MYELITIS.] Angular curvature of the spine (Pott's curvature), which is a disease produced by the involvement of the vertebræ by tubercular disease, with eating away of their substance and the formation of collections of matter, usually produces symptoms attributable to the pressure which is exerted under the abnormal conditions upon the portions of the spinal cord which are enclosed within the diseased structures. Spina bifida is a form of congenital malformation in which there is a sac-like protrusion of the membranes of the cord through a cleft left in the wall of the enclosing bony canal, the non-closure of the cleft being the result of imperfect development.

Spindle-Tree (*Euonymus europæus*), a British shrub, belonging to the order Celastraceæ, the wood of which was formerly known as *prickwood*, *skewernood*, *pegwood*, and *dog-wood*. It has ovate-lanceolate, glossy, deciduous leaves, small, pale-green, tetramerous flowers, and fleshy, deliscent, rose-pink fruits of three or four united carpels, each of which, on splitting, discloses an orange aril covering the one seed it contains. Tennyson speaks of this as

"the fruit,

Which in our winter woodland looks a flower."

Evergreen exotic species, especially *E. japonicus* and *E. latifolius*, are largely grown in our London squares, and flower freely on our southern coasts.

Spindle Whorl, a small perforated disc formerly used to increase the momentum and maintain the rotation of the spindle. [SNAKE-STONES.]

Spine, a leaf, or part of a leaf, modified into a pointed, hard, woody structure. The term is so often interchanged with thorn (q.v.) that it is perhaps better to speak specifically of a *leaf-spine*. In the thistles and hollies only the teeth of the leaves become spinous; in *Robinia* and most acacias, the stipules (q.v.); in some cases, the primary rachis or phyllopodium of a pinnate leaf after the fall of the leaflets; and in various barberries, marginal teeth or even the whole leaf. The spines of the Cactaceæ are mostly leaf-structures. Spines differ from thorns in being lateral and from prickles in being continuous with the woody tissue of the branch or stem.

Spinelle, or SPINEL, is a compound of the oxides of magnesium and aluminium, its composition corresponding to the formula $MgAl_2O_4$. It occurs naturally, crystallising in forms of the Rhombic system. The crystals may be colourless or tinted, owing to the presence of other metallic oxides which may partially replace the magnesium. By this partial replacement we may thus obtain iron spinelle, a zinc spinelle, etc., with formulæ $(MgFe) Al_2O_4$, $(MgZn) Al_2O_4$, etc.

Spinning, the process of preparing woollen or other fibre for weaving, is of high antiquity. The most ancient form seems to have been the distaff, on which the wool was arranged, and the spindle, weighted by a whorl, around which the thread twisted itself as the spindle revolved. The next step was to employ the spinning-wheel, by which the spindle was turned. For a long time this wheel formed a familiar object of furniture in every well-appointed house, but it is now well nigh obsolete. Vast improvements have been made by the invention of carding-machines and the spinning-jenny, which revolves scores of spindles at once at an incredible speed and yet requires only one woman's attention.

Spinola, AMBROSE, MARQUIS (1569-1630), a famous Spanish general under Philip III., first served in Flanders, and in 1604 took Ostend after a stubborn defence of some years. He was made commander-in-chief of the Spanish army in the Low Countries, where he was stoutly opposed by Maurice of Nassau. He afterwards served in Italy with much success, taking Casale, and gaining various victories for Spain.

Spinoza, BENEDICT (1632-77), philosopher, was the son of a Portuguese Jew, and was born in Amsterdam. He took a deep interest in religious systems from an early age, and made himself intimately acquainted with the Bible and the Talmud, the result of which was to convince him that the Jewish religion of his fathers was not worthy of credence. He translated his first name of Baruch into Benedict, and, despite bribes and other inducements to remain a Jew and much persecution and ill-treatment, he boldly proclaimed his scepticism. He studied the various systems of philosophy and made himself proficient in Latin, Greek, metaphysics, and mathematics. He was excommunicated, and was obliged to seek refuge in Leyden, whence he afterwards proceeded to the Hague. In order to procure a livelihood, he worked for the optical instrument makers, but he did not neglect his philosophical researches. Descartes interested him above all other thinkers, and he wrote a very valuable work about his system. Though charged by his enemies with atheism, he was nothing of the kind, but a Pantheist, believing in God as the eternal and ever-present spirit of nature. The doctrine of free-will he rejected, and individuality finds no place in his scheme. He was a truly religious man, and profoundly influenced many subsequent thinkers and poets. Quite a library of books was written in defence of and against his theories. Personally he was most amiable, and his

friends were many and true. *Tractatus Theologico-Politicus* (1670) is his chief work, and he also wrote an admirable treatise on ethics.

Spiræa, a large genus belonging to the order Rosaceæ, including both herbaceous and shrubby perennial plants, natives of the extra-tropical parts of the northern hemisphere. Their leaves are generally stipulate; their flowers small in large anthelæ; the calyx persistent; the stamens indefinite in number; and the fruit a ring of five or more follicles. There are two British species: *S. Ulmaria*, the meadowsweet, and *S. Filipendulâ*, the dropwort, and numerous Japanese, Chinese, and other species are grown in our gardens; but the Japanese plant, commonly sold as *Spiræa japonica*, is truly *Astilbe barbata*, and belongs to the order Saxifragaceæ. It has a cluster of long stiff hairs at the base of the stalk of its tri-ternate leaves, and was at one time named *Hoteia* in honour of a Japanese botanist Ho-tei.

Spires (German, *Speyer*, anc. *Augusta Nemetum*, or *Norionagus*), an old town on the left bank of the Rhine, 21 miles south of Worms and in the Bavarian Palatinate. Captured by Julius Cæsar in 47 B.C., it became the seat of a bishop in the 4th century, and of an imperial palace under the Franks about 850. From 1527 to 1689 the supreme court of the empire was established here. All the ancient buildings perished by fire in the latter year except the grand Romanesque basilica, dating from 1030. Only a few fragments remain of the Retscher, or imperial palace, where the Diet of Spires met in 1529, and gave to the Reformers the title of Protestants.

Spiriferidæ, a family of Brachiopoda, or Lamp Shells, common in the Palæozoic rocks, and characterised by the fact that the calcareous rods (or brachia) which support the arms are arranged as a spiral coil. The family ranges from the Silurian to the Lias.

Spirits of Wine, ordinary or ethyl alcohol. [ALCOHOL.]

Spiritualism, in a philosophical sense, denotes the opposite of materialism, and maintains that over and above the matter that composes the human body there is a further informing principle that enables the body to perform its functions. But in a more popular sense it denotes the doctrine that living people can hold converse with disembodied spirits, chiefly by the intermediary of certain peculiarly gifted persons called mediums. This doctrine, like many other startling things, originated in America, where in 1848 Mr. Fox of New York, with his family, was disturbed by sundry rappings, which practice enabled them to decipher as messages from spirit-land. In 1850 Mr. Home made further developments, such as levitation, etc. Most of the phenomena of rapping, table-turning, spirit-photography, spirit-writing, and the like, can be and have been produced by ordinary means, and much imposture has undoubtedly been practised by some mediums. But after all deduction made there appears to be a residuum of

phenomena thus far unexplained by scientific examination, though what this may imply is a matter of conjecture. Among men of trained minds who have become converts to spiritualism are Mr. A. R. Wallace, Mr. Crookes, F.R.S., and Professor De Morgan. There are quantities of spiritualistic literature extant.

Spirula, a small Cephalopod, the type of the family *Spirulidae*, which belongs to the Octopoda (q.v.). It has a small coiled shell composed of many chambers; this, however, is now rudimentary and internal. The shells are very abundant on the beaches of all tropical coasts.

Spithead, a roadstead at the entrance to Portsmouth Harbour, extending, with a length of 2 miles and a breadth of $1\frac{1}{2}$ mile, along the Spit Sand, and protected by several forts. The name is often applied to the whole reach of water between Hants and the Isle of Wight. Owing to the good anchorage it serves as a rendezvous for the Channel Fleet.

Spitz, the Pomeranian dog, a breed with a strain of Esquimaux blood. The coat is thick and the nose long and pointed. These dogs are kept as pets, but their temper is said to be uncertain.

Spitzbergen, a group of rocky islands in the Arctic Ocean, 400 miles N.W. of the North Cape. It consists of six large and many smaller members. West Spitzbergen, the chief, has an area of over 15,000 square miles, a deeply indented coast, and a mountainous surface covered almost entirely with ice and snow. N.E. of this lies North-East Land, which is a broad plateau swept by a glacier often 3,000 feet thick. S.E. is Stans Foreland, and farther E., across Olga Strait. Wicke, or King Charles Land. The formation of all is granitic, and they rise from a comparatively shallow submarine plain connecting them with Greenland. A branch of the Gulf Stream keeps the access to the west coast open even till late in the year, and permits the growth of a scanty Arctic vegetation. Reindeer are rather plentiful, and the ice-fox and polar-bear also exist, birds being exceedingly numerous. The sea abounds in Cetaceans, though the Greenland whale is almost exterminated.

Spleen. The spleen is a flattened oblong body which in the adult weighs about 7 ounces; it is situated in the left hypochondriac region adjoining the cardiac end of the stomach. It is invested in a capsule consisting of connective tissue and unstriped muscular tissue fibres, from the inner surface of which processes, or trabeculae as they are called, project and ramify in the interior of the spleen, forming the supporting framework to the spleen tissue proper (the spleen pulp). This last-named substance is of a dark reddish-brown colour, and consists of a mass of cells, many of them like ordinary lymph corpuscles, and many resembling degenerated red blood-corpuscles. The splenic artery enters the organ at a notch on its under surface, known as the hilum, and branches and ramifies in the spleen pulp, its smaller divisions

being surrounded by aggregations of lymphoid tissue which form little masses, disseminated throughout the spleen substance, and known as the Malpighian corpuscles of the spleen. The blood conveyed to the spleen in its passage through the lymphoid tissue and spleen pulp undergoes important changes; it is probable that many of the red blood-corpuscles here terminate their existence, and numbers of new white corpuscles appear to be formed. The spleen undergoes rhythmical contraction and expansion in virtue of the large amount of muscular tissue contained in its capsule and trabeculae; it manifests a notable increase in size a few hours after a meal. The spleen has no duct, and is hence classified with the thymus, thyroid, and other bodies as one of the ductless glands. In certain forms of disease great enlargement of the spleen occurs. This is markedly the case in ague and in typhoid fever; in the malady known as leucocythæmia the spleen attains sometimes a very large size.

Spleenwort. [ASPLENIMUM.]

Splenic Fever. [ANTHRAX.]

Splint, a form of surgical appliance designed to keep a portion of the body in a fixed position. Splints are of special service in the case of fracture of a bone where it is necessary to preserve the proper apposition of the injured parts with a view to favouring the processes of repair, and securing the coalescence of the broken ends in such a position that no deformity shall result. Splints are usually made of pieces of padded wood, which are adjusted to the injured limb by strapping and bandaging. Plaster-of-Paris is largely used in the manufacture of splints, a bandage, into which the dry powder has been rubbed, being applied to the limb and moistened with water as it is adjusted, and every care being taken to preserve the parts in proper position until the plaster sets.

Spohr, LUDWIG (1784–1859), composer, was born in Brunswick, and studied under Franz Eck. In 1805 he became musical director at the Court of Saxe-Gotha, and in 1813 director of the Vienna theatre, where he produced a number of operas, including his *Faust*, *Jessonda*, etc. His reputation slowly travelled outside Austria, and he made several visits to England and France. He was considered the greatest violinist of his time, and became recognised as a master when his fine oratorios of *The Last Judgment* (1826), *Calvary* (1835), and *The Fall of Babylon* (1840) were performed.

Sponge, the skeleton of the animals forming the Porifera, a class of animals belonging to the phylum Cœlenterata (q.v.). The members of the Porifera differ very markedly from the remaining Cœlenterata by their very varied and variable shape; they form irregular masses, the individual members of which have no tentacles, and thus appear far less highly organised than the compound Anthozoa (q.v.). A few, however, have a definite shape. This is typically shaped like a funnel, and is shown in its simplest form in such a genus as

Leucosolenia; in others it becomes more complex, and consists of a tubular structure supported by a trellis-work of silica, as in the exquisite "Venus' Flower Basket" (*Euplectella*); in others the sponge consists of a fleshy, creeping mass, as in *Homoderma*, the type-genus of the *Homodermidae*; in others (the family *Clionidae*) the animal lives in borings in shells. In attempting to form an idea as to the structure and affinities of a sponge it should be regarded as composed of a large number of cells belonging to two different layers, separated by the gelatinous, irregular material known as "mesogloea." The two layers are the ectoderm and endoderm; the former consists of flattened cells, and forms the external layer of the body. The endoderm is typically composed of larger cells, each with a whip-like process or flagellum, which rises from the centre of a neck-like extension or collar; so these cells resemble a rounded bottle with a short, thick neck, with a cord rising from the centre of the neck. The endoderm lines a series of tubes, which ramify through the mass of the sponge; the typical "collared cells" may line the whole length of these (in the Homocœla) or be restricted to special parts of the tubes or bladder-like expansions of them known as ampullæ (as in all but this order). These tubes may open to the exterior by a series of pores, which occur in great abundance over the whole surface of the sponge; they may be all of the same size, or some may be small (micropores) and others large (macropores). The pores are typically "inhalant"—i.e. the currents of water which bring the sponge its food and fresh water for respiratory purposes all enter the sponge by them; but in those sponges which have not also a series of larger exhalant apertures known as "oscula" some of the pores have to allow of the escape of the surplus water. The oscula begin as a single large aperture, which usually divides into many small ones. The tubes which ramify through the sponge form the "gastric cavity," which may consist of (1) a simple, central, vase-shaped cavity, as in such primitive forms as the *Asconidae*; (2) this central cavity may be replaced by a series of radial exhalant canals as in the *Syconidae*; (3) it may consist of a series of canals with ampullæ—i.e. pear-shaped or spherical expansions. The skeleton of the sponge consists of a series of "spicules" or small rods formed by cells in the mesogloea; they are composed either of a soft but tough material allied to silk and known as "spongin," as in the common sponge (*Euspongia*); of silica, as in the Venus' Flower Basket; or of carbonate of lime, as in the sub-class Calcarea. The spicules are of four main types: (1) monaxile—simple rods, curved or straight; (2) triaxile—composed of three rods crossing, and thus usually six-rayed, as in *Hexactinellidae*; (3) tetraxile—composed of four rods, but one of these is often suppressed—these occur in the *Lithistidae*; (4) polyaxile—of many axes, and forming stellate or globular spicules; these are free. The spicules are either united to one another by interlocking spines, or by spongin or the deposition of carbonate of lime or silica; or they may be free, and are then known as "flesh spicules." The sponges are classified in the main, according to the structure of the skeleton and

the nature of the gastric cavity. By the first character they are divided into two sub-classes—the Calcarea, in which the skeleton is composed of carbonate of lime; and the Fibrospongiæ or Non-calcarea, in which the skeleton is composed of silica or spongin, or is absent. The Calcarea are divided into two orders, according to the second character; thus in the Homocœla the gastric cavity is lined throughout with collared cells, and in the Heterocœla the collared cells occur only in special portions of the gastric cavity, either in radiating tubes or special bladder-like expansions known as ampullæ. The first order includes the three families of the *Asconidae*, *Homodermidae*, and *Leucapsidae*; the latter consists of the families of *Syconidae*, *Sylleibidae*, *Leuconidae*, and *Teichonidae*. The Non-Porifera are divided into three orders:—(1) The Hyalospongiæ, including all the Hexactinellida, which are very abundant as fossils, and range from the Cambrian period onward; the group is characterised by the possession of a siliceous skeleton composed of six-rayed spicules often united into a lattice-like tissue. The "Venus' Flower Basket," or *Euplectella*, is the best-known living species. (2) The Spiculispongiæ, in which the skeleton is composed of siliceous spicules which are either four-rayed or consist of a single spine; these are often quite disconnected. It includes five sub-orders: the Lithistina, in which the skeleton is massive, and the spicules united to one another—this group is very important to the geologist; Tetractina, with four-rayed and one-ray spicules; Oligosilicina, with only small isolated flesh spicules; Pseudotetraxonia, with one-rayed and flesh spicules; and the Clavulina, including the boring Sponges, *Cliona*. (3) The Cornacuspongiæ, with spicules if present only of a single spine, united by spongin, or formed only of spongin fibres. This includes two sub-orders: the Halichondrina, of which the freshwater sponge (*Spongilla*) is the best-known form; and the Keratosa, including all the soft sponges of commerce. The systematic position of the sponges has been much debated, but embryological evidence is conclusive as to their being Cœlenterata. The sponges are all marine, except the two freshwater genera, *Spongilla* and *Meyenia*. The others occur in all seas and at all depths, but the Hexactinellidæ usually occur in deep water. The sponges vary in size from minute bodies, $\frac{1}{10}$ inch in length, to enormous masses. Many species occur round the English coasts. The sponges used for washing purposes live in shallow water in warm seas; the best ones come from the Levant and Greek archipelago, but the largest part of the supply is yielded by the West Indian fisheries, especially around the Bahamas. Owing to the indestructibility of the spicules, the sponges are of great importance to the geologist, for they are abundant as fossils from the Cambrian period onward. Their spicules often occur in such abundance on "fossil sponge banks" as to form thick beds of siliceous rock, such as the cherts of the Lower Greensand.

Spongilla, the common freshwater Sponge. It may be found attached to stones and wood in either stagnant or running water. There is one

English species, *Spongilla lacustris*, while a closely allied form, *Meyenia fluvialis*, lives in streams. The latter grows in dense masses, while the true *Spongilla* is erect and plant-like. When it grows well exposed to light it is of a green colour.

Spontaneous Combustion occasionally occurs in bodies when they are in such a state that they can undergo intense chemical action; the energy of the action may be sufficient to cause luminosity and flame. Many substances in a fine state of division will take fire in the air. Reduced iron, for instance, becomes oxidised so rapidly that heat and light are both produced. When powdered antimony is dropped into chlorine the two elements combine with so much vigour that brilliant sparks are formed. If lead tartrate be heated in a tube for some time, all the carbon is burnt away, and the tube can be sealed up while hot with its fine deposit of lead. When the tube is opened the lead takes fire as it comes in contact with the air. Phosphorus can be exposed at ordinary temperatures in the air without catching fire; but if it be dissolved in carbon bisulphide and the solution be allowed to evaporate, the deposit of phosphorus ignites spontaneously. Charcoal under certain conditions—*e.g.* when saturated with oil—has been known to take fire suddenly, and the presence of certain compounds of iron in coal has been known to cause its spontaneous combustion. Many organic substances will also undergo fermentation or oxidation sufficient to cause their ignition, if they are massed in large quantities. This is specially common in the case of hay or straw ricks when the ricks have been made of damp material. Cotton-waste saturated with oil, greasy woollen rags, and other things of a similar nature, are all liable to sudden combustion. The cases of so-called spontaneous combustion of the human body have generally been explained in some more satisfactory manner. In most cases a person impregnated with alcohol has actually caught fire and been burnt, the combustion starting from without and not spontaneously.

Spontaneous Generation (*generatio eque-roca* or *abiogenesis*), the view held by Aristotle and championed of late years by Bastian, that some of the lowest organic beings originate from non-living matter. This view was attacked by Redi and by Leeuwenhoek (1632–1723), though defended by Lamarck (1744–1829). Whatever speculation may have to say as to the first origin of life in the remote past, all experimental evidence as to “sterilised” organic infusions, etc., is against any such process taking place at present.

Spontini, GASPARO LUIGI PACIFICO (1774–1851), Italian composer, was the son of a peasant, and received his musical education at Naples. At the age of seventeen he produced his first opera with great success at Rome. He was a prolific composer, and from that time forward wrote unceasingly. After living in Naples till 1803 he went to Paris, where he brought out other works, and was appointed conductor of the Italian Opera there. In 1820 he went to Berlin, and in the following year his finest work, *Olympia*, was performed. He was very popular at that time, but his reputation decreased

rapidly and his works were speedily forgotten by the public.

Spoonbill (*Platalea leucorodia*), a large wading bird allied to the ibis and the stork, and named from the spoon-like enlargement of the tip of the bill. It was formerly native in the fen country, but now occurs only as a visitor. Holland is its nearest breeding-place, but it is common over Northern Europe. The length is about 30 inches; the plumage is white with a pinkish tinge, and the bill and legs are black. The flesh is valued for the table. The Roseate Spoonbill (*P. ajaja*), from Central America, differs little from the common species except in its plumage.

Spore, a specialised reproductive cell, in itself asexual, capable by itself of giving rise to a new organism. The spore may originate either *asexually*—*i.e.* from a single mass of protoplasm—or *sexually*, from the fusion of two masses. It is generally a single cell or nucleated mass of protoplasm. It may have no cell-wall and may then be motile, when it is termed a *zoospore* (q.v.). Zoospores may be *ciliated*, as in many Algæ and in a few Fungi, or *ameboid*, as in the Myxomycetes (q.v.) and in a few Algæ. The non-motile naked spores of the Florideæ are either *tetragonidia*, produced asexually, or *carpospores*, produced sexually. When a spore has a cell-wall it is commonly thick, and may consist of two layers—the outer cuticularised *ectine*, *exine*, or *exospore*, and the more delicate inner *intine* or *endospore*. The asexually-produced spores of the sporophyte are either all alike, as in most ferns, horsetails, and Lycopodium, when the plant is termed *homosporous* or *isosporous*; or they are of two kinds, differing in size and in the sex of the organs to which they give rise. The plant is then termed *heterosporous*, as in the case of the Selaginella, the Hydropterideæ, and the Spermatophytes, the smaller spores, which give rise to male organs, being termed *microspores* or *pollen-grains*, and the larger *megaspores*, *macrospores*, or *embryo-sacs*. Asexually-produced spores originate in a *sporangium* or by *abstriction*, a process of budding on a branch hypha. In thallophytes the sporangium is unicellular; in higher plants it is multicellular; and in heterosporous forms two kinds of sporangium occur, the *microsporangium* or *pollen-sac*, and the *megasporangium* or *ovule* (nucellus). Sporangia are generally borne on special leaves or *sporophylls*, such as the staminal and carpellary leaves of Spermatophytes, but are in some cases axial. In ordinary ferns and Hydropterideæ the sporangium originates from one cell (*leptosporangiate*); in other vascular plants, from a group of superficial cells (*ensporangiate*).

Sporophore, or SPOROPHYTE, the stage or generation in the life of a plant that produces asexual spores, as distinguished from the alternating stage or generation, the *gametophyte*, in which sexual reproductive organs are produced. In Bryophyta and in most Thallophyta the sporophore is relatively small and of an appendicular character, being, for instance, in mosses what is known as the capsule or *theca*, with its stalk or *seta*.

In Pteridophyta the sporophore becomes relatively far more important than the gametophyte, being the entire stem and leaves of the leafy plants, whilst the gametophyte is merely the prothallium. In flowering-plants, again, the sporophore becomes even more important, being the whole plant except the contents of the pollen-grains and the archisperm.

Sporozoa, a class of Protozoa (q.v.), including those which live as parasites within other animals, and which reproduce by the formation of spores resembling in some cases those of some plants. The individuals either have no special organs of locomotion or only some imperfectly developed pseudopodia. The class is divided into four groups—viz. the Gregarinida (q.v.), which live in earthworms, frogs, mollusca, etc.; the Amœbosporidia, which infest beetles; the Sarcosporidia, or "Rainey's corpuscles," which live in the muscles or soft tissues of some mammals and birds; and the Myxosporidia, which are parasitic in fish. The Gregarinida is the best known and most important subclass.

Spottiswoode, WILLIAM, F.R.S. (1825–83), scientist, was born in London, his father being the Queen's printer. After completing his education at Harrow and Oxford, he turned his attention to scientific studies, and pursued them after succeeding his father as head of the printing establishment. He was an accomplished Orientalist and mathematician, but was most remarkable as a physicist. His greatest work is that on *The Polarisation of Light*, upon which there was no greater authority. He published numerous important papers, and in 1879 was elected President of the Royal Society. He was buried in Westminster Abbey.

Sprain. As the result of a sudden wrench or fall injury is often inflicted on some of the soft parts of the body, and particularly on the muscular and ligamentous structures, without actual breach of continuity of the bones. Pain and swelling occur, and to such a condition, in the absence of actual fracture or dislocation, the term sprain is applied. Sprains are particularly common in the neighbourhood of joints, the ligaments of which may be stretched or torn in consequence of the injury. The treatment of sprains in the early stages consists in insisting on rest for the affected parts, and in the application of cold lotions, lead lotion being that usually employed. Later, the employment of warmth is often grateful to the patient, and as soon as inflammation has subsided friction of the part involved should be resorted to, and the patient should move it about with a view to preventing the formation of a stiff joint.

Sprat (*Clupea sprattus*), a small fish of the Herring family, found in great numbers on many parts of our coasts and on the coasts of Europe washed by the Atlantic. In shape and colour it closely resembles the herring, but is much smaller, and may be easily distinguished from the larger fish by the sharply-notched edge of the abdomen, by the more forward position of the ventral fins, and by the absence of vomerine teeth. Sprats are

often taken in immense numbers, so that the market is overstocked, and large quantities are used for manure. Sprats are excellent eating, and would be more highly valued if they were not so plentiful. Large quantities are dried for future use or export; on the Baltic coasts they are cured with spices; and at Deal are factories where they are put up in oil like sardines. The ova of the sprat are shed in the open sea, though not far from land, and the young fry are sold as whitebait.

Spree, THE, a river which rises in the circle of Bautzen, Saxony, and flowing N.W. joins the Havel after a course of 220 miles at Spandau. It passes through the heart of the city of Berlin, and drains a large portion of the province of Brandenburg. It is connected by canal with the Oder.

Sprengel Pump is used for obtaining good vacua. [AIR PUMP.]

Sprenger, ALOYS (b. 1818), eminent German orientalist, was born in the Tyrol, and studied at Innsbrück and in Vienna. His interest in oriental peoples dated from an early period, and in 1836 he collaborated with Münster in the great work on *The Military Sciences among the Mussulmans*. In 1843 he went to Calcutta, and held various appointments in other Indian cities, and after his return to Europe became professor of oriental languages at Bonn. He published various works, including translations into English of *The Gulistan* of Sadi (1851), a *Life of Mahomet* (1851), and *Selections from Arabic Authors* (1845). He also translated English works into Arabic, and wrote in German *The Life and Doctrine of Mahomet* (3 vols., 1861–65).

Spring Balance is a weighing machine dependent for its action upon the fact that the extension of a spiral spring is proportional to the applied force. In its simplest form it is merely such a spring flexed at its upper end and provided at its lower end with a hook or pan to hold the article to be weighed, and an index moving over a graduated scale. In order to obtain greater sensitiveness, a rack and pinion or their equivalent is sometimes used to cause the movement of the lower end of the spring to result in the rotation of a pointer over a graduated dial. In some balances the weight is measured by the amount of bending produced in a flat curved spring, to one end of which a pointer is fixed.

Springbok (*Gazella euchore*), a beautiful South African antelope, some 30 inches high, deriving its popular name from its great agility and marvellous leaps. It frequents the sandy plains, and is found in large herds, which make partial migrations in search of food. The general colour is brown above and white beneath, marked off on the flanks by a broad wine-red band. On the back are two folds of skin which open when the animal leaps, and show a broad white patch.

Springfield. 1. The seat of the chief arsenal of the United States, is in Massachusetts, on the E. bank of the Connecticut river, and 98 miles S.W. from Boston. Here is made the regulation rifle of the United States Army, and private

factories also exist for producing watches, needles, buttons, and goods of silk and cotton. It has good public buildings, including a fine library.

2. The capital of Illinois, United States of America, stands on a plateau 4 miles from the Saugamon river, and 95 miles north-east of St. Louis. The adjacent coalfields have made it a prosperous manufacturing centre, and large markets for agricultural produce and livestock are also held. The fine State Capitol contains a Memorial Hall of the Civil War.

Springs, the risings of underground waters to the surface of the ground, may be broadly divided into two classes—*surface* or *gravitation springs*, where the water descends continuously to the point of outflow, and *deep-seated springs*, where it rises by hydrostatic pressure. Those of the first class mostly occur in undisturbed strata, where a porous bed cropping out at the surface receives rainfall; its water is held up by an underlying impermeable bed, and at some lower level the line of junction of the two beds comes to the surface. The second, more common, class occurs in disturbed areas, the water following a labyrinthine up-and-down course through subterranean fissures and joints, and often reaching the surface along a line of fault. The water of springs may range in temperature almost from the freezing-point, as in some *glacières* or deep caverns in snow-clad mountains, up to boiling-point. Hot or *thermal* springs are most frequent in volcanic regions, but may occur elsewhere (as at Bath, where they have a temperature of about 120° F.), when they probably come from a considerable depth. Spring water contains in solution atmospheric gases, carbon dioxide from the soil, and various gases from deeper rocks. Organic acids may be present, and mineral constituents mainly vary in proportion according to temperature, from less than 1 to 300 grams per litre. The chief mineral salts present are calcium, magnesium, and sodium carbonates, calcium and sodium sulphates, and sodium chloride. When more than 1 gram per litre is present the water ceases to be ordinary drinking water, and the spring is termed a *mineral spring*. Where drinking-water only contains alkaline salts and dissolves soap without forming curd it is termed *soft*, but where calcium, magnesium, or ferrous carbonates, sulphates, or chlorides are present, curd is formed from the fatty acids of soap, and the water is called *hard*. Hardness due to bicarbonates, which are decomposed by boiling, the carbonate being precipitated, is termed *temporary*; that due to the undecomposable sulphates and chlorides as *permanent*. The chief kinds of mineral springs are *calcareous*, containing calcium-carbonate; *chalybeate* or *ferruginous*, containing ferrous sulphate, which decomposes and deposits iron rust (hydrous oxide); or *saline*, containing a brine chiefly of chlorides, with calcium sulphate and various other substances. Mineral springs believed to have curative effects are called *medicinal*, of which the chief varieties are the *sulphurous* containing hydrogen-sulphide, as at Harrogate; the *bitter*, containing magnesium-sulphate, as at Cheltenham and Sedlitz; and the *alkaline*,

containing especially sodium-carbonate. *Oil-springs* contain a variable proportion of petroleum (q.v.) mixed with their water. In addition to feeding rivers, the chief geological action of springs (at the surface) is the deposition of travertine (q.v.), which when rapid gives them the name of *petrifying* springs, though they merely encrust with carbonate of lime. Chalybeate springs produce an ironstone *moorband pan* below the surface in badly drained districts, and the hot waters of geysers contain in solution large quantities of silica, which they deposit as *geyserite* or *siliceous sinter*.

Spruce, a name commonly applied to the whole of the coniferous genus *Picea*, but especially to *P. excelsa*, the Norway Spruce. The genus is characterised by its scattered four-sided leaves with projecting cushions below them; pendulous woody cones, with thin scales, ripening the first year and falling off whole; short, concealed, almost free bracts; winged pollen-grains: small seeds with large obovate wings; and four- to five-lobed cotyledons, each lobe being three-edged. The Norway spruce is a handsome tree, growing best in moist valleys and reaching 150 feet in height. Its timber is known as *white deal*, but in Northern Europe is not nearly as valuable as that of the Northern pine (*Pinus sylvestris*). A resin known as *frankincense* exudes from the stem, and *Burgundy pitch* is prepared from it. An infusion of the young shoots is used in the preparation of *spruce beer*, which contains treacle and is fermented with yeast. Some sixty varieties in cultivation for ornament have been named. Other well-known species of *Picea* are *P. alba* and *P. nigra* (also known as *P. rubra*); natives of North-East America.

Spumellaria. [RADIOLARIA.]

Spur. 1. A pouch-like appendage to perianth leaves, connected with the secretion of nectar. In *Tropæolum* the spur is mainly formed from one sepal, as also in *Pelargonium*, in which it is adherent. In *Biscutella*, a genus of *Cruciferae*, two sepals are spurred; in *Viola*, one petal; in *Epimedium grandiflorum*, all four; and in the *Columbines*, all five petals. In most spurs the nectar is excreted by the inner surface and received in the pouch; in *Viola*, the secretion is performed by the two tail-like appendages of the stamens; and in orchids, which were in consequence mistakenly termed by Sprengel “sham nectar-producers,” it takes place within the tissues of the petalline spur, so that the insect-visitor has to bore for it. The length of a spur is in relation to that of the proboscis of the insect-visitor. That of the Madagascar orchid, *Angræcum sesquipedale*, is 9 inches in length.

2. An instrument for goading the flanks of a horse, worn on the rider's heel, furnished up to early mediæval times with a single point, and subsequently with a rowel (or revolving ring armed with three or more radiating points). Spurs were used by the Romans as early as 200 B.C. They were named after, and perhaps copied from, the horny claw-like outgrowth (from the side of the metatarsus) on the foot of many birds. They are attributes of knighthood; so that “to win one's

spurs" means primarily to gain the honour of knighthood, and then to make oneself a reputation. In history "The Battle of the Spurs" was the bloodless rout of the French knights by Henry VIII. near Guinegate, in the north of France, 1514. The term is applied to sundry subordinate lateral offsets, and used metaphorically for a momentary stimulus or impulse. In botany a spur is a calcar or hollow formation projecting from a flower, as from the corolla of the violet and from the calyx of the nasturtium.

Spurge. [EUPHORBIACEÆ.]

Spurgeon, REV. CHARLES HADDON (1834-1892), eminent Baptist preacher, was born at Kelvedon, in Essex, where his father was a clergyman. He received most of his education at Colchester, and on its termination was for a time tutor at Newmarket. Commencing evangelical work at Cambridge whilst a mere boy, he won a reputation as "The Boy Preacher," and was only seventeen when he was appointed to the charge of a Baptist chapel. In the same year he came to London, and held a pastorate at Southwark with such success that his chapel was always needing enlarging. Meanwhile his fame grew steadily, and he not only preached often, but wrote considerably. In 1861 the Metropolitan Tabernacle, with which his name will be always connected, was opened, and he drew enormous congregations, slowly extending its work until it possessed almshouses, a college for pastors, orphanages, and other institutions. His sermons were constantly and extensively published and were widely read, and are collected into many volumes. Many of them first appeared in a small publication edited by Spurgeon, and called *The Sword and Trowel*. His jubilee was celebrated in 1884.

Spy, one who in war ventures among the enemy in the guise of a friend or a neutral, or under cover of night, to observe their condition and discover their plans in order to report thereon to his own leaders. If detected, a spy is liable to execution.

Square-Root. If $a^2 = b$, then a is said to be the square-root of b , where b is any expression. For real expressions the method of finding the square-root is a modification of the process of long division, the method used in arithmetic being simply deduced from algebra. If we are dealing with a perfect square, it is of the form $x^2 + 2xy + y^2$, or x^2 and $y(2x + y)$, and this forms the basis of the rule by which x and y would be found in turn. The square-roots of expressions containing surds and imaginary quantities are found by special methods. A *practical* method of finding the square-root of a number is to use logarithms. For since $a^2 = b$, $\log a^2 = \log b$, $\therefore 2 \log a = \log b$; hence the rule is to look up the logarithm of the number and halve it. The result is the logarithm of the required root.

Squares, METHOD OF. [METHOD OF LEAST SQUARES.]

Squaring the Circle. [QUADRATURE.]

Squills, the genus *Scilla*, bulbous plants belonging to the order Liliaceæ, with a tunicate bulb (q.v.), linear radical leaves, a racemose scape of blue, white, pink, or purple flowers; a deciduous perianth of six free, or nearly free, segments; epiphyllous stamens, one style, and a loculicidal capsule (q.v.). Of the sixty species, twenty of which are European, three are British, viz.:—*S. nutans*, the bluebell or wild hyacinth; *S. verna* and *S. autumnalis*. *Urginea Scilla*, formerly known as *Scilla maritima*, a Mediterranean species, separated by its more spreading perianth leaves and more numerous seeds, is the source of the drug known as Squills. Its bulbs are chiefly imported from Malta, those of light colour being the best. They have a bitter or acrid, and even vesicant, character from the presence of a substance known as *scillitin*. The preparations of this drug contained in the Pharmacopœia are a tincture, the compound squill pill, the pill of ipecacuanha and squill, and the acetum scillæ. From the last-named are prepared the oxymel scillæ and the syrupus scillæ. The pill of ipecacuanha and squill contains opium in the proportion of 1 part in $23\frac{1}{2}$ parts. The action of squill resembles that of digitalis. It is a cardiac tonic, and produces constriction of the peripheral arterioles, followed by relaxation which is in the first instance marked in the small vessels of the kidney, and squill has thus a diuretic action. Squill is, moreover, a powerful expectorant, and is much employed in chronic bronchitis. It has, however, an irritant effect upon the stomach and intestines, and its administration has to be carefully regulated on this account.

Squint. [STRABISMUS.]

Squirrel, a book-name for any individual of the Rodent sub-family *Sciurina*, with seven genera, universally distributed except in the Australian region; and especially for those of the type-genus



SQUIRREL (*Sciurus vulgaris*).

Sciurus, with about seventy-five species, of which only three belong to the Palearctic region. They are arboreal animals, with long, bushy tail; pointed ears, which are generally tufted; with four digits

and a rudimentary thumb on the fore limbs, and five digits on the hind limbs, armed with long, sharp, curved claws. The species vary in size from that of a cat to that of a mouse, and attain their greatest size and most brilliant coloration in the tropics. The Common Squirrel (*S. vulgaris*) ranges over the whole Palearctic region. Its total length is about 18 inches, of which the tail counts for nearly half. The fur is reddish brown above (tinged with grey in winter) and white below. It is essentially a wood-dweller, and its diet is almost exclusively vegetable, though it is very fond of birds' eggs, and sometimes eats beetles and grubs. It builds a roofed nest or "drey," in which the young are born. These animals hibernate, taking their winter sleep in holes in trees, having previously laid up a store of provisions to serve them when they wake up, as they do from time to time. [FLYING SQUIRREL.]

Staal, MARGUERITE JEANNE, BARONESS DE (1693-1750), known as Mdle. de Launay, was born in Paris, and was very religiously brought up, yet managed to acquire a considerable knowledge of the systems of Descartes and Malebranche. She was left by her mother in poor circumstances, and entered the household of the unamiable Duchesse de Maine. She was mixed up with the politics of her day, and was kept in the Bastille for a couple of years. Her charming manners and high intelligence made her admired by many, including the Baron de Staal, whom she married. Her *Mémoires*, first published in 1755, and her *Letters* form delightful reading.

Stability is of two kinds, static and kinetic. A body possesses static stability or is in stable equilibrium when, after any slight displacement, it tends to return to its original position. A weight hanging at the end of a string is in this state. We may give it a push in any direction, but it will sooner or later return to its lowest position. Any body is in stable equilibrium when a vertical line through its mass centre falls within the figure obtained by joining the points of support. A three-legged table may be tilted up and will resume its own place again so long as this vertical line remains within the triangle formed by the three feet. A body possesses instability when any slight displacement causes it to completely change its position. An egg standing on its end is obviously in this condition. Certain bodies may be displaced without afterwards recovering their original position or departing farther from it. These are said to be in neutral equilibrium, and the best example is that of a sphere on a flat surface; the sphere may be moved and will remain wherever it is placed. A body possesses kinetic stability when it tends to remain in a steady state of motion. A hoop remains erect while in motion, and the planets remain in their orbits in virtue of their velocity. A small displacement of either the hoop or planet causes no permanent change in their behaviour; they both maintain a definite average position.

Stael-Holstein, ANNE LOUISE GERMAINE, BARONESS DE (1766-1817), the eminent French writer, was the daughter of Necker, the great

Finance Minister of Louis XVI. She was given a first-class education, and the society she met at her father's house helped largely to develop her genius. Her highly-strung and nervous temperament found a congenial attraction in the writings of Jean Jacques Rousseau, and her first work was a series of letters on them, published in 1788. In 1786 she married the Baron de Stael-Holstein, Swedish ambassador at Paris, and, as was often the case in such *mariages de convenance*, had not expressed any affection for him, he being much older than herself, but socially a desirable husband. For some years they lived at Paris, and she took a very active part in the events which occurred during the early period of the Revolution, sustaining the royal family by her sympathy, and doing a great deal to mitigate their troubles. In 1793 she published a very powerful appeal in behalf of the Queen, and shortly after left Paris, in time to escape the Reign of Terror. Returning in 1795, her salon became the centre of much literary and political activity, and, after the rise of Napoleon, viewed his actions with great suspicion. She detested him cordially, and the dislike was mutual. In every possible way she opposed his will, and finally enraged him so much that in 1801 she was ordered to quit Paris in twenty-four hours—a *coup* which cruelly wounded her, as it broke up her salon and lost her some adherents. Her husband died in 1802, and she went to Germany, where she became the friend of Goethe, Schiller, Wieland, and others. In the year mentioned she published one of her chief works, *Delphine*, a romance which attracted many readers by its passionate, poetical style. After travelling about a great deal, she once more entered France; but in 1807, on the publication of her best-known work, *Corinne*, she was again compelled to leave it. Her next great work was the book on Germany—*L'Allemagne*—which had a tremendous effect on French literature, as it first introduced to her countrymen the leading German writers, and proved to be one of the germs of the romantic movement in France. *L'Allemagne* was seized by the censors and destroyed, and Madame de Stael, who had again settled in France, left that country for the last time and settled in Switzerland, where she died. Her *Considérations sur la Révolution Française* and her *Dix Années d'Exil* were her latest works of consequence. The latter was published after her death, and is a record of her persecution by Napoleon. Beyond doubt Madame de Stael exercised more influence with her contemporaries than any other woman of modern times.

Staffa, an islet of the Inner Hebrides, Scotland, $6\frac{1}{2}$ miles N. of the Ross of Mull. It has a circumference of about $1\frac{1}{2}$ mile, and is famous for its basaltic columns and caverns, Fingal's Cave being an attraction to thousands of summer visitors. It is 227 feet long by 42 feet broad, and has a height of 66 feet.

Stafford, a midland county of England, and its capital. The former lies between Derbyshire E. and Shropshire W., having Warwickshire and Worcestershire S.W. and S., and Cheshire N. The area is about 1,170 square miles, being mostly level,

though broken by picturesque hills such as Axe Edge (1,756 feet), Cloud Thorpe, and Mow Cop in the N. Rivers are abundant, the Trent, the Dove, the Sow, and the Tame being the chief; a small



FINGAL'S CAVE, STAFFA.

tract is drained by the Severn. Agriculture thrives fairly in the valleys, but pastures are largely in excess of arable lands. The wealth of the county depends, however, on coal and iron. Wolverhampton, Walsall, Tipton, Bilston, Wednesbury, Newcastle-under-Lyme, and West Bromwich are the chief centres of hardware manufactures; whilst the potteries at Stoke, Hanley, and Burslem employ many hands. Tamworth, Lichfield, and Rugeley are towns of importance, in addition to STAFFORD, the capital, which stands on the river Sow about 29 miles N.W. of Birmingham. Its origin dates from long before the Conquest, and, though outside the coal-bearing districts, it is a growing town, its prosperity being largely due to the leather and boot trades. The churches of St. Chad and St. Mary are interesting structures. There is a grammar school founded before Edward VI., a museum, and a fine library due to the gift of the Salt family. The borough returns one member to Parliament.

Stag. [RED-DEER.]

Stag-Beetles, a group of beetles belonging to the family *Lucanidae*, and including the largest of British beetles. The name is derived from the large horns possessed by the males. The largest British species is *Lucanus cervus*, of which the males are sometimes over two inches in length. The larva is a large fleshy, wood-eating grub, and may have been the "Cossus" which was eaten by the Romans as a great delicacy.

Staghound, a strongly-built, shaggy-coated variety of the Greyhound (q.v.), formerly used in Scotland to track and pull down wounded deer. With the altered conditions of sport the necessity for these dogs has ceased, and they are now chiefly kept as pets. The coat is generally yellowish-grey or iron-grey, with white on the breast. The name is also given to the large hounds used to hunt the red-deer.

Stahl, GEORG ERNST (1660-1734), German chemist, was a native of Anspach, and studied at Jena, subsequently becoming professor of medicine at Halle in 1694. His knowledge of chemistry was very great, and he made some important discoveries, establishing the phlogistic theory of chemistry, and strongly insisting on the futility of explaining all the phenomena of physical action by mere mechanical laws, and asserting the existence of the soul. He became physician to the King of Prussia in 1716. His most valuable works are the *Theoria Medica Vera*, *Fundamenta Chymia*, and *Experimenta*.

Stalactite and Stalagmite, the names arbitrarily applied respectively to icicle-like mineral deposits formed by the evaporation of a dripping solution, and to crystalline deposits of similar origin in layers on a more level surface below. Various minerals occur in a stalactitic form, such as chalcedony, iron-pyrites, and baryte, whilst kidney-iron and malachite are practically stalagmitic; but the most familiar example of the process is in the rows of stalactites of calcite that mark lines of joint on the roofs of limestone caverns and the layers of the same composition on their floors. As each drop gathers on the roof and begins to evaporate and lose carbonic acid, the excess of carbonate which it can no longer retain is deposited round its edges as a ring. Drop succeeding drop lengthens the original ring into a long pendent tube, which, by subsequent deposit outside, becomes thickened and may, after reaching the floor, be indefinitely increased in diameter. At first the calcareous deposit is soft; but it becomes crystalline, fibrous crystals radiating outwards from the central tube. The further evaporation of the water which drips on to a comparatively level floor forms the more distinctly crystalline *stalagmite*, which rises from its regular layers into ridges and pinnacles under the rows of stalactites. The rate at which the deposits take place depends upon rainfall, porosity, etc., and cannot be used as a safe measure of time.

Stall, one of a range of seats against the sides and screen of a cathedral choir or of a college chapel, generally having side partitions, and often a canopy and miserere. The term is used to designate

the dignity of a canon. In the theatre a chair or partitioned seat; now one of the seats in the front part of the pit, which is called the stalls.

Stalybridge stands on the Tame, the boundary of Lancashire and Cheshire, $7\frac{1}{2}$ miles east of Manchester, and rose into importance at the end of the last century as the site of the first cotton-mill, steam-power, too, being first used here for spinning and weaving. It now possesses large factories for cotton and woollen goods, iron and brass wares, and nails. There are fine public buildings and a large park. In 1857 a municipal charter was obtained, and in 1867 the town received the right of returning a member to Parliament.

Stamen, the male sporophyll of a flowering plant, consisting typically of the usually thread-like *filament* surmounted by the *anther* (q.v.), which contains the *pollen* (q.v.). In its earliest stages, in almost all cases, a stamen closely resembles a foliage-leaf. As it develops there is generally a central bundle of spiral vessels, or midrib, and certain hypodermal cells (*archesporium*) give rise to the *pollen-sacs* (*sporangia*), which are generally four, though afterwards merged into two chambers (*loculi*). In them originate the pollen-mother-cells. The two outer layers of cells in the anther become specially modified, the outer into a slightly cuticularised epidermis or *exothecium*, the inner, or *endothecium*, into a layer of spirally-thickened cells interrupted in the region at which the anther splits when ripe. The central portion of the stamen between the pollen-sacs is termed the *connective*. It is usually small, but in the violet it is produced into a triangular buff-tip, and in two of the stamens is also *appendiculate*, being furnished with a tail-like nectariferous appendage at the base of each, which is enclosed in the spear of the corolla. In heaths there are two similar processes, non-nectariferous, at the base of each anther. In the horn-beam the connective bifurcates, each branch bearing an anther-lobe or *dimidiate* (i.e. halved) anther, whilst in the sage (*Salvia*) the connective is a long, unequal-armed lever, with an anther-lobe at each end, the lower one abortive. When the connective is thus enlarged the anther is termed *distractile*. If the filament be absent, the anther is *sessile*; whilst if the more essential anther be absent, the stamen or filament is *abortive* or *sterile*, and is commonly termed a *staminode*.

The stamens may be described with reference to their (1) number, (2) relative length, (3) union or cohesion, (4) insertion or adhesion, (5) form of filament and anther and the mode of insertion of the latter on the former, and (6) mode of dehiscence of anther.

The number of stamens in a flower may vary from one to twelve, twenty, or more, and the first eleven classes of the artificial system of classification proposed by Linnæus are named according to this character. The stamens are commonly equal in length, but sometimes of various lengths, according to their order of development; and if they are in more than one whorl, those of one whorl are often longer than those of another, as in the purple loosestrife. In the special cases of four

stamens, two long and two short, characteristic of most Labiatae (q.v.) and Scrophulariaceae (q.v.), and of six stamens, four long and two short, as in Cruciferae, they are known as *didynamous* and *tetradynamous* respectively.

The stamens may either be *free*, as in all the Linnæan classes as yet referred to, or they may be united by their filaments, by their anthers, or by both. Some of the cases of apparent union by the filaments are truly due to branching (*chorisis*). Intercalary growth of a zone of tissue below all the stamens carrying them up on a tube, as if all united by the lower part of their filaments, as in Malvaceae, geranium, furze, broom, etc., produces what is called the *monadelphous* condition. Most Leguminosae (q.v.) have ten stamens, nine united and one free. This is termed *diadelphous*, whilst the branching of three or more stamens produces the condition known as *polyadelphous*. The Compositae (q.v.) are the most important case of the union of stamens by their anthers, which Linnæus styled *syngenesious*, and the Cucurbitaceae illustrate union by both filaments and anthers. The insertion or adhesion of the stamens can usually be described by the same terms as that of the corolla—viz. *hypogynous*, *perigynous*, or *epigynous*; but in gamopetalous (or gamophyllous) flowers, owing to intercalary growth beneath both the corolline and the staminal whorl, they often appear to spring from the petals, corolla-tube (or perianth), and then are termed, in addition to being hypogynous or epigynous, as the corolla may happen to be, *epipetalous* (or *epiphyllous*), as in the primroses, lilac, etc. In orchids and a few other plants the stamens are adherent to the gynæceum, forming a column or *gynostemium*, and the flower is then termed *gynandrous*.

Though commonly thread-like or *filiform*, the filament is sometimes, as in grasses, so slender, hair-like, or *capillary* as to bend under the weight of the anther. In other cases it is broader at the base, tapering like an awl or *subulate*, or it may be broad and *petaloid*.

The anther (q.v.) is sometimes attached to the filament or to its direct continuation, the connective, throughout its whole length, as in water-lilies, violets, etc., when it is termed *dorsifixed* or *adnate*. In other cases it is articulated at its base to the apex of the filament, and is called *basifixed* or *innate*, as in sedges (*Carex*); or, again, it may be only attached by a point about the middle of its back so that it can turn freely as on a ball-and-socket joint, and is therefore called *versatile*, as in grasses and lilies. In *Salvia* the long connective is attached in this way to a short stout filament, on which it swings like the ancient quintain.

To discharge its pollen when ripe, the anther generally splits or *dehisces longitudinally*, by a slit down the face of each lobe, as in lilies, grasses, violets, etc. When short and rounded, it sometimes dehisces *transversely* by a horizontal split, as in *Alchemilla*. In the heath family (*Ericaceae*) dehiscence is *porous*, by a hole at the top of each lobe, the lobes in some genera, such as the cranberries, being produced upward into tubular processes. In the barberry and in the bay-tree

dehiscence is *opercular* or *valvular*, two parallel splits and one transverse one on the face of each lobe forming a little door or *operculum*, which folds back in an upward direction. Dehiscence is often an important classificatory character, and from this point of view we must observe not only the mode, but also the direction in which it takes place. In *Compositæ*, *Amaryllidaceæ*, and *Liliaceæ* the anthers burst towards the centre of the flower, and are termed *introrse*; in *Berberis*, *Iridaceæ*, and *Colehiceæ* they burst outwards—i.e. towards the perianth—and are called *extrorse*. [ANTHER, POLLEN.]

Stamford, one of the oldest municipal boroughs of England, is situated partly in Lincolnshire, partly in Northants, on the river Welland. It appears in history soon after the Roman period, and was one of the five Danish boroughs. In the 13th and 14th centuries it almost rivalled Oxford and Cambridge as a seat of education. It returned a member to Parliament under Edward III., and was incorporated under Edward IV., and now gives its name to an electoral division of Lincolnshire. An excellent High School and several charitable institutions still survive. Its present importance is due to a large trade in agricultural products, but implement-making, waggon-building, and iron-founding are also carried on.

Stammering. This defect of speech is characterised by lack of co-ordination in the muscular movements of inspiration or expiration, or in those of the glottis or of the lips and tongue. The complex series of ordered muscular movements concerned in the production of speech is, in the person who stammers, deranged and thrown out of gear by the involvement of one or other of the muscles in a condition of spasm. Stammering is usually first met with in early childhood. It often becomes worse up to the period of puberty, and then frequently improves. Nine-tenths of the sufferers are males. It is sometimes hereditary, and is occasionally met with in persons who belong to families with a history of nervous disorders. Something can be done to remedy the condition by insisting on slow and deliberate speech. In some cases considerable improvement has resulted from the practice of intoning in speaking. In many cases, however, although improvement may occur, it is impossible to effect an absolute cure.

Stamps, authoritative impressions made on papers or parchments used for official or business purposes for which fees or duties are charged by Government, the specified instruments being invalid unless stamped. Stamps are also purchased from Government for affixing to postal packages (as payment for carriage and delivery) and documents liable to duty, such as receipts and agreements.

Standard of Time. In order to have a standard of time we must have a perfectly reliable and uniform motion as a means of measurement. The rotation of the earth on its axis is uniform and constant; hence equal intervals of time occur

between any two successive passages of a fixed star across the meridian. If we divide the time between such passages into twenty-four hours, we shall obtain the sidereal hour; but this is by no means convenient in ordinary life. It is convenient in obtaining certain astronomical measurements, and a sidereal clock (q.v.) is to be found in every observatory; but a certain hour on that clock—say 8 o'clock—may mean any time during the night or day, according to the time of year, and hence would be practically useless to people generally. On the other hand, the period between two successive passages of the sun across the meridian—a solar day—is far more convenient, and, if the sun travelled uniformly round the equator, it would be a perfectly simple thing to obtain the value of a solar hour. [TIME.] The sun, however, does not behave in this way; it moves in the ecliptic instead of the equator, and its motion is irregular. An imaginary sun is, however, supposed to move under these simple conditions and to perform its complete journey in the same time as the real sun; it, in fact, takes an average of the sun's motions, and the day obtained in this way is known as a mean solar day. A clock which neither loses nor gains is regulated to this *mean time*, while observations on the sun itself would give *apparent time*. The correction to be applied to the apparent time to convert it into mean time is known as the EQUATION OF TIME (q.v.), and is never greater than 16' 18".

Standing Stones, a general name for unhewn monoliths. When occurring singly they are called Menhirs; and if disposed in a ring, Stone Circles (q.v.). The Standing Stones of the British Isles and of the Continent are prehistoric, and commemorate some event, as a battle, or mark a burial-place, the latter having in many cases been discovered by excavation. The Standing Stones of Scotland probably mark interments of the Bronze Age; those of Norway belong to the Iron Age. In the North-East of India Standing Stones are still used as sepulchral monuments and as offerings to ancestral spirits.

Stanfield, WILLIAM CLARKSON, R.A. (1793–1867), painter, was the son of Irish parents, and in early life served in the navy, where his taste for drawing was discovered. He met with an accident which incapacitated him for service, and then became a scene-painter, afterwards exhibiting landscapes and marine subjects. His fame spread quickly, and he was elected an A.R.A. in 1832 and R.A. in 1835. He was one of the best artists of his time, and many of his finest pictures are in the London galleries.

Stanford, CHARLES VILLIERS (b. 1852), composer, is a native of Dublin, and was educated at Cambridge University, where he became organist of Trinity College in 1873 and conductor of its Musical Society in 1874. He has published much excellent music, among which may be noted his operas of *The Veiled Prophet* (1881), *Saronarola* (1883), and *The Canterbury Pilgrims* (1884), and his cantatas *Revenge* and *The Voyage of Macbeth*.

Stanhope, JAMES, 1st Earl (1673–1721), English statesman and soldier, was born at Paris. He entered the army, and, having served brilliantly at the siege of Namur in 1695, was made a colonel. He had a distinguished career in the army, was present at the siege of Barcelona, and subdued Minorca, and gained several successful battles in the Peninsula. He afterwards entered political life, and in 1714 became Secretary of State, and Prime Minister in 1717, an office which he only held three months. He received a peerage and subsequently an earldom, and carried out some important diplomatic missions with much skill.

Stanhope, PHILIP HENRY, 5th Earl (1805–75), statesman and historian, entered Parliament in 1830. In 1834 he entered the Ministry as Under-Secretary for Foreign Affairs, and, after the death of his father and his consequent removal to the House of Lords, he did not take a very prominent part in political affairs, but devoted himself to historical studies. Previously he had made, as Lord Mahon, a reputation by his *History of the War of the Succession in Spain* (1832) and his *History of England* (1836–54), both very solid and admirable works. He wrote several other works also, most notable of which are his *Life of Pitt* and his *History of the Reign of Queen Anne* (1870).

Stanley, VERY REV. ARTHUR PENRHYN (1815–81), Dean of Westminster, was born at Alderley, in Cheshire. His father, rector of that place, afterwards became Bishop of Norwich, and his uncle was the first Lord Stanley of Alderley. He was first educated at a private school, and was sent in 1829 to Rugby, where the famous Dr. Arnold exercised great influence over him, an influence which remained with him to the end. After a career of very great distinction at Balliol College, Oxford, he took orders, and in 1840 became a fellow of University College, of which he was tutor for twelve years. In 1844 he published his *Life of Arnold*, and in the following year was appointed select preacher to the University. His *Memoir of Bishop Stanley* came out in 1850, and in 1851 he was made Canon of Canterbury. A lengthened tour in the East led to the publication in 1855 of one of his most popular books, *Sinai and Palestine*. Just previously he had brought out an excellent work, *Historical Memorials of Oxford*. He held the professorship of ecclesiastical history at Oxford for some time, and among his chief theological works may be named the *Commentary on the Epistles to the Corinthians* (1854), *Lectures on the Eastern Church* (1861), *Lectures on the Jewish Church* (three series, 1862–75), *The Athanasian Creed* (1871), and *Lectures on the Church of Scotland* (1871). In 1862 he went to the East with the Prince of Wales, and in 1863 became Dean of Westminster, in which year he also married Lady Augusta Bruce. Her death in 1876 affected him greatly and hastened his own. He was buried in Westminster Abbey. He was an admirable writer and a fearless Broad Churchman, raising some opposition by his pronounced views. He was, however, deeply respected by friends and opponents.

Stanley, HENRY MORTON (b. 1840), African explorer, was originally named John Rowlands, and was born at Denbigh, in Wales. He was deserted in childhood, and commenced life as a cabin-boy at the age of fifteen, voyaging to New Orleans. He joined the Confederate army in the Civil War, but afterwards served in the Federal navy. In 1867 he was sent by the *New York Herald* to describe the British expedition to Abyssinia, and the same paper subsequently sent him to search for Dr. Livingstone in the heart of Africa. He discovered Livingstone, and showed that what the latter thought was the Nile was really the Congo. In 1872 his book, *How I Found Livingstone*, appeared. He represented the *Herald* during the Ashantee War, and published *Coomassie and Magdala* in 1874, after which a second journey to Africa was made, resulting in some valuable discoveries. The expedition was described in his *Through the Dark Continent*, 1878. In the following year he returned there, and, helped by the King of Belgium, founded, despite many difficulties, the Congo Free State in 1884. His last noteworthy feat was his expedition in 1887 to find Emin Pasha, which was also successful. On his return he was loaded with honours and rewards, and married Miss Dorothy Tennant, the artist. *In Darkest Africa* appeared in 1890, and is a record of terrible experiences and remarkable discoveries.

Stannaries, districts in which mines of tin (Latin, *stannum*) are located.

Stannates. [STANNIC ACID.]

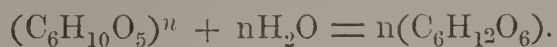
Stannic Acids. Two compounds, in which an oxide of tin acts the part of an acid, are known: (1) *stannic*, and (2) *metastannic* acid. The first may be obtained as a gelatinous precipitate by the addition of an acid to one of its salts—*stannates*. Of these salts sodium *stannate* is very largely employed in calico-printing; it is obtained by boiling caustic soda with dioxide of tin, and has the formula $\text{Na}_2\text{SnO}_3 \cdot 3\text{OH}_2$.

Stannic and Stannous Salts. [TIN.]

Star of India, ORDER OF, an order, founded in 1861, for the British possessions in India.

Starch is a carbohydrate having the composition $(\text{C}_6\text{H}_{10}\text{O}_5)_n$, which occurs in granules in most green plants. It is generally formed by plastids; in leaves and other parts exposed to light, within chloroplastids; in rhizomes, tubers, roots, or other parts not exposed to light, in contact with leucoplastids. A watery central mass, the *hilum*, is first formed, and then layers are added by apposition, the grains within plastids being commonly concentric, whilst those merely in contact with a plastid at one end grow most at that end and become excentric. The form and size of the grain is characteristic of different species, so that the adulteration of food-starches can be readily detected by the microscope. The smallest known grains are those of rice, less than one five-thousandth of an inch across: the largest, those of *tous-les-mois*, one three-hundredth. The grains are doubly

refracting and appear stratified. They contain from 2 to $5\frac{1}{2}$ per cent. of a less soluble substance known as *farinose* or *starch-cellulose*, forming a skeleton to the granule, the remainder being formed of the more soluble *granulose*. Starch, or rather granulose, turns blue with iodine and is very inert. When heated with water the grains absorb the water, swell, and ultimately burst, forming *starch-paste*; but not until heated to a very high temperature does it become truly soluble. When treated with malt extract (diastase), saliva or the pancreatic secretion, starch passes into *dextrin*, which is isomeric with starch, and *maltose* ($C_{12}H_{22}O_{11}$). The ultimate product of its hydrolysis by dilute sulphuric acid is *dextrose* or grape-sugar ($C_6H_{12}O_6$), thus:—



In the process of assimilation in green plants starch is the first visible product; but it originates from sugar (q.v.) in solution, and is itself always of the nature of a reserve substance. After the sugar has passed from the leaves to stems, roots, or seeds, starch is re-formed in them by leucoplastids. In germinating seeds or at the rise of the sap, diastatic action once more turns the starch into sugar. Starch is the most important heat-giving or force-producing ingredient in human food. Potatoes contain 15, wheaten bread 48, haricots 49, peas 51, oatmeal 63, maize 64, rice 76, and sago, tapioca, arrowroot, and cornflour about 83 per cent. of starch. Besides its use under these various forms as food, enormous quantities of starch, which in England are made chiefly from rice and maize, are employed for laundry purposes and for stiffening textiles.

Star-Chamber, an extraordinary court sitting at Westminster to try cases in which the Crown was especially interested, established as a regular criminal court by a statute of Henry VII., consisting of a committee of the Privy Council. The court sat in the "Star Chamber" of the old House of Lords, and took cognisance of offences against the public welfare not specially within the jurisdiction of other courts. But its jurisdiction was gradually extended, and it became an arbitrary, secret, and cruel instrument of despotism. In 1584 it gagged the press at Whitgift's instigation. After being indefatigably employed in the repression of liberty under Charles I., it was abolished in 1641.

Starfish belong to the phylum Echinodermata (q.v.) and the class Asteroidea. A short account of the anatomy of the commonest English Starfish is given under *Asterias*, and of the classification under Asteroidea. There are forty-two species living in the British seas: they mostly inhabit shallow water, but many are found in very deep water: thus *Nymphaster* ranges down to 9,000 feet. The best-known British species are the Sun Star (*Solaster papposa*), which has many rays from a central disc; the thin leathery *Palmipes*; the tiny pentagonal *Asterina gibbosa*; the long-armed *Luidia*, famed for the suicidal habit of voluntarily breaking up its body; *Asterias rubens*, the

common English Sand Star, and its larger and more northern ally, *Asterias glacialis*.

Starling, a book-name for any bird of the Passerine family *Sturnidæ*, and of its type-genus *Sturnus*, with about ten species, all from the Old World. Unlike most birds of the order, they walk and do not hop, as one may see sparrows do. The Common Starling (*Sturnus vulgaris*) is a well-known British bird, about eight inches in total length; the plumage of the adult male is black, with green, purple, and violet metallic reflections, and the feathers, except those of the head and neck, bear a triangular buff spot at the tips. These spots are more conspicuous in the winter dress. Starlings are insect-eating birds, and associate in large flocks in the winter. The nest is a rude structure of straw and grass lined with feathers and wool, and contains from four to seven bluish-white eggs.

Stars. Most of the celestial bodies keep the same apparent distance from each other and are known as the fixed stars; they differ from the planets by a peculiar twinkling of their light. [SCINTILLATION.] On a very clear starry night about 2,000 stars may sometimes be seen by the eye alone in the northern hemisphere, but countless numbers are brought into view by a powerful telescope. In early times the stars were divided into constellations, these being named after some animal or mythological person to which they bore some fancied resemblance. The positions of the stars in the constellation were then noted. Some stars were considered brilliant enough to merit a special name, such as Sirius, Algol, etc. Early in the seventeenth century Bayer produced a celestial atlas in which he named the different stars in each constellation after the letters of the Greek alphabet. Thus we have α Tauri (Aldebaran), α Canis Majoris (Sirius or the Dog Star), β Orionis (Rigel), etc. The Greek letters are supposed to represent the order of brightness of the different stars in their constellation, α denoting the brightest. When the Greek letters are used up, ordinary letters are called in, and finally numbers are invoked. The description of the position of stars is, however, often given in a confusing manner from different catalogues, so that photographs of the sky are much more easily understood. Stars are divided into *magnitudes* according to their brightness with respect to all other stars regardless of any particular constellation, and those down to the 16th and 17th magnitude can be viewed with the best telescopes, the 6th being only just visible to the naked eye. The difference in brilliancy is due to the fact that the stars themselves are not equally bright, and also that their distances from us vary enormously. Some stars, however, have different magnitudes at different periods. These are known as variable stars, and the change in brightness occurs over regularly recurring periods. Double stars generally exhibit different colours—for instance, the two stars known as α Herculis are respectively red and blue. But single stars differ greatly in colour; Aldebaran is red, while many stars exhibit a

white or bluish-white colour. The fixed stars experience changes in their number. Some disappear, while new stars sometimes start into existence. In 1572 it is recorded that a new star brighter than Venus appeared in Cassiopeia, but its colour and brightness gradually underwent change until at last it vanished. It may be that these new stars are simply recurrences of variable stars of very long periods. By means of careful observations on the annual parallax (q.v.) of the stars the distances of some of them have been measured. α Centauri in the southern hemisphere gives the greatest value of this parallax ($\cdot 75$ seconds), and is therefore the star nearest to us. In spite of this, however, it is so far away that light takes $4\frac{1}{2}$ years to travel the distance. Light from the pole star takes over 42 years. Most of the stars are, however, so far away that their parallax is too small to be observed. Besides nebulae (q.v.), clusters of stars very near to each other can be observed in different spots, and the individuals in these groups seem to exercise some influence upon each other, but their real connection is not understood. It has been observed that some of the stars have a motion in the sky which is known as the proper motion of the stars; in some cases it amounts to an apparent motion of 7 seconds a year, which means an immense real velocity of the star itself. The spectroscope [SPECTRUM] has revealed the constitution of many of the stars, and has shown that they are bodies very like the sun. It has hence been inferred that they *are* suns, and the sizes and brilliancy of some of them have been calculated; many are thousands of times greater and more luminous than our sun.

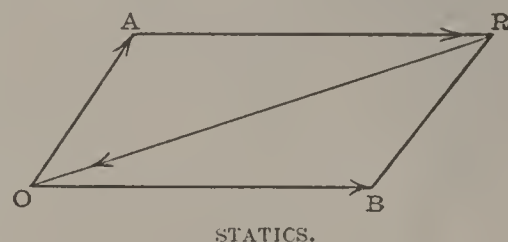
Staten Island forms Richmond county in the State of New York, United States of America, and lies opposite to the capital on the farther side of New York Bay, being separated by the Narrows from Long Island. It is triangular in shape, and has an area of about 59 square miles, with an undulating surface rising to over 300 feet in the north. Agriculture flourishes, and iron-ore is worked, but fishing is the most profitable industry.

States-General, the national legislative bodies of the Netherlands, and of France before 1789.

States' Rights, DOCTRINE OF, one of the distinctive tenets of the Democratic party in the United States, *i.e.* that the individual States enjoy all rights, powers, and privileges not specifically made over by the terms of the Constitution to the central government, some extreme theorists maintaining the States' right of secession.

Statics is that branch of Dynamics (or Mechanics) which deals with the balancing of forces acting on any body. Although such a balancing of forces causes the body to appear at rest, we must remember that we are never in a position to regard anything as *absolutely* at rest. We can only deal with *relative* rest. A body which appears perfectly still with regard to the earth, is at the same time whirling through space with the velocity of our planet, so its condition of rest is only relative. The problem of statics is the discovery of the conditions

which determine that any number of forces acting on a body shall produce equilibrium. If two forces OA , OB , act at a point O , their resultant is OR . [PARALLELOGRAM OF FORCES.] Hence a force RO is exactly sufficient to balance the two forces OA and OB . But AR is equal to OB , so that the system of forces OA , AR , RO , forming the *closed* figure OAR , is in equilibrium. This proposition can be extended, and it is quite simple to prove that if any number of forces acting at a point can be represented in magnitude and direction by the sides of a closed polygon taken *in order*, those forces will be in equilibrium. This is known as the



Polygon of Forces. If two forces act on a body, this condition can only be fulfilled when the forces act at a point, are equal in magnitude and opposite in direction. If the forces act in a plane at different points of a body, the simplest method of arriving at the conditions of equilibrium is to revolve the forces in two directions at right angles to each other. [RESOLUTION OF FORCES.] Then the sum (algebraical) of the forces in each of these two directions must be zero; but this is not all. Since the forces are not acting at a point, they may produce a rotation, and for this not to happen the sum of the moments of the forces [MOMENT] about any point in their plane must also be zero. If forces act on a rigid body in any directions whatever, the conditions for equilibrium are that the algebraical sums of the components of the forces about each of three axes at right angles must be zero, and the sums of the moments of the forces about the same three axes must also be zero. An important set of problems in statics is concerned with finding the centres of gravity or mass centres of different bodies, the forces under consideration being in that case the weights of the different particles composing the body. Equilibrium may be stable, unstable, or neutral [STABILITY], and the state of greatest stability is reached when the body possesses the minimum potential energy. [ENERGY.]

Stations of the Cross, THE, the representations in art of the successive stages of the Passion of Jesus Christ, placed in or near a sacred edifice so as to be visited in order by the devout.

Statius, PUBLIUS PAPINIUS (61–96 A.D.), Latin poet, was born at Naples, and was taught by his father, a literary man of repute. He settled in Rome, and only returned to Naples at the close of his career. His works consist of two epics, entitled respectively *Thebais*, in 12 books, and the unfinished *Achilleis*, in 2 books, and a collection of short pieces named *Silvae*. These poems, and especially the latter, have been often reprinted, but they do not give Statius a very high place among the Roman writers. His adulation of Domitian has not tended to enhance his fame.

Statutes at Large, an authentic collection of the various statutes which have been passed by the British Parliament from very early times up to the present day. The oldest of these now extant and printed in our Statute Book is the famous Magna Charta as confirmed in Parliament, 9 Henry III., though doubtless there were many Acts before that time, the records of which are now lost, and the provisions of which are in the present day currently received for the maxims of the old Common Law or customs of the realm. The statutes from Magna Charta down to the reign of Edward II. (including also some which, because it is doubtful to which of the three reigns of Henry III., Edward I., or Edward II. to assign them, are termed *incerti temporis*) compose what have been called the *vetera statuta*; on the other hand, those from the beginning of the reign of Edward III. are contradistinguished by the appellation of the *nova statuta* (*Dwarris on Stat.* 626).

Statute of Uses was passed in the reign of Henry VIII. (27 Henry VIII. c. 10). It, in effect, enacted that the *use* should be the land, and that where the use was there the land *or legal estate* should be, and should be deemed to be. In consequence of this statute the word "use" departed from its original signification, and became equivalent to seisin or legal estate.

Staurolite, a silicate of aluminium with peroxide of iron, crystallising in cruciform macles belonging to the Rhombic system, the name being derived from the Greek *stauros*, a cross. It is generally an opaque brownish colour, with conchoidal fracture; is infusible; and has a specific gravity of about 3.5 and a hardness of 7 or 7.5. It occurs in slates and mica-schists as a result of metamorphic action.

Stavanger, a seaport of Norway, on the picturesque Stavanger Fjord, about 100 miles S. of Bergen. The cathedral, begun in 1272 on the site of an older building, is a fine specimen of Northern Gothic. Besides being a favourite centre for tourists, the place does a brisk trade by sea, and has a large fishing fleet.

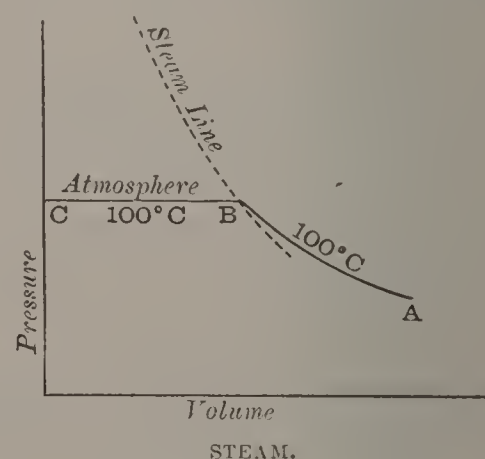
Steam is water in the state of vapour. Although it is popularly supposed that steam is only produced when water is boiling, it can, in point of fact, exist at any temperature. The humidity of the atmosphere is simply due to the presence in it of water vapour or steam. Further, the amount of water vapour present in any space depends only on the temperature, and is independent of the presence of other gases. If we have a vessel, closed by a movable piston and containing nothing else but a little water, that water will begin to evaporate, and continue this action until the space above it is *saturated* with vapour. At this point the number of molecules which force their way out of the liquid through its surface layer is exactly counterbalanced by the number which return from the space above. There is therefore equilibrium, and as long as the temperature remains constant the pressure of the vapour is unaltered. If we attempt to increase the pressure of the vapour by pushing

in the piston (still keeping the temperature the same), we find our efforts unavailing. Some of the steam condenses; it is less in quantity, but its pressure persists, and this pressure is known as the *vapour pressure*. Steam at the vapour pressure, therefore, is just on the point of liquefying, and is said to be *saturated vapour*. The following table gives the vapour pressure of steam at different temperatures:—

Temp.	Vapour Pressure in Millimetres of Mercury.	Temp.	Vapour Pressure.	Temp.	Vapour Pressure.
—32°C.	.320	20°C.	17.39	100°C.	760
—20	.929	40	54.90	110	1,075.37
—5	3.113	60	148.79	130	2,030.28
0	4.6	80	354.64	150	3,581.23
10	9.165	90	525.45	200	11,688.96

Below the freezing-point, it is evaporation of the ice itself which produces water vapour; solid and gas exist together without the presence of the liquid form.

We can give heat to the water in our closed vessel till all is converted to saturated vapour. On applying further heat we cause the temperature of the vapour to rise; it is no longer saturated, but is said to be *superheated*, and then we can increase the pressure without causing condensation. The steam, in fact, behaves like any other gas; pressure and volume vary inversely, diverging but slightly from conformity with Boyle's law. At any one temperature we can plot out a curve showing the



connection between the volume and pressure of the steam, and such a curve is known as an isothermal. At 100° C. there will be a curved portion, A B, differing very slightly from a hyperbola; then when the pressure is one atmosphere, the vapour is saturated. We cannot increase the pressure further, but steady diminution of volume occurs as more liquid is formed, and this is indicated by the straight line B C. Every temperature gives a similar curve, but the length of B C gets less and less as we take higher temperatures, until at one point it vanishes. This point is known as the *critical point*. Here the temperature, pressure, and volume have fixed values—not easy to determine experimentally, however. The critical temperature of water is 365° C., and above this temperature it is impossible to liquefy steam by pressure.

If we drew a number of isothermals and connected all at the point B, we should get a curve showing the volumes and vapour pressures of saturated steam at different temperatures. This curve is known as the *steam line*. It bends up towards the critical point, where it meets a corresponding curve showing the volume of the condensed water formed at different temperatures, and called the *water line*. It is not possible to show on a small scale the volume of water formed, since the volume of saturated steam at the same temperature is so enormously great compared to it. For instance, 1 lb. of water will occupy .016 of a cubic foot at 212°, while the steam formed from it will be 26.36 cubic feet. If BC represent the latter quantity, .016 vanishes from view on the same diagram.

Since heat must be given to water to convert some of it into steam, and both remain at the same temperature, it is obvious that this heat has been used up in some other way which a thermometer is unable to indicate. This is known as the *latent heat* (q.v.) of steam, and at 100° C. it requires as much heat to convert a pound of water into a pound of steam as to raise 5.36 lbs. from 0° to 1° C. This is expressed by saying that the latent heat of steam is 5.36. When once the steam is formed, however, the heat required to raise its temperature one degree is less than water would require for a similar purpose, the specific heat of steam being only .4805. If steam is being generated in a closed vessel, the temperatures of water and steam can both rise above 100° C., the pressure of course increasing. At 112° C. we know the pressure is 1 atmosphere; at 120° it is 2 atmospheres; at 134° it is 3, and at 143° it is 4. Hence we note the enormous force exerted on the vessel as heat is applied to it, the force doubling itself twice during a temperature rise of only 43° C. Great care is therefore necessary in dealing with steam under these conditions; otherwise it is liable to burst the vessel in which it is confined, the possibility of such a result being demonstrated with moderate frequency by boiler explosions.

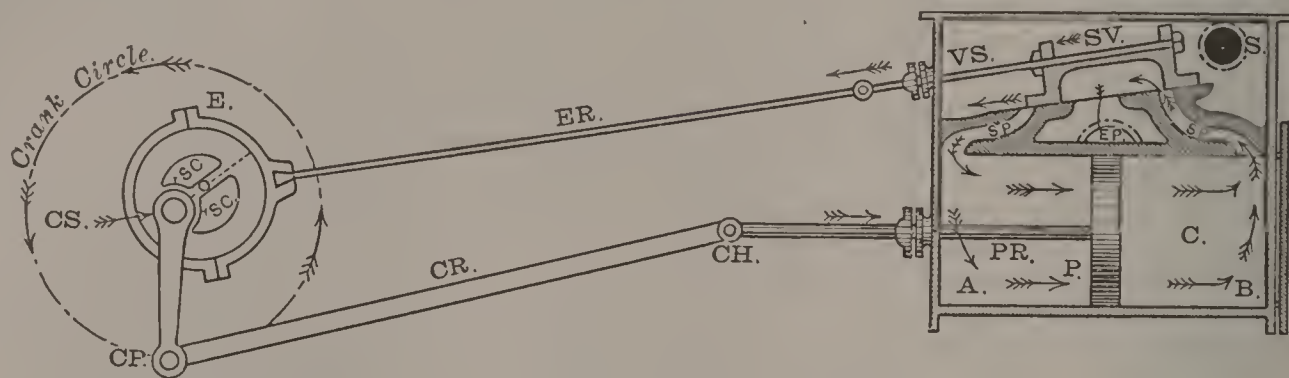
Steam Carriage. [TRACTION ENGINE.]

Steam-Engine is a machine for doing work by means of the elastic force of steam. In the earliest practicable form of engine—devised by Newcomen about 1712, and used to some extent for pumping water from mines—steam was admitted from a sort of overgrown kettle into a cylinder provided with a piston, which was arranged to be lifted by the weight of the pump-rod. Cold water was then injected into the cylinder, and the consequent condensation of the steam produced a partial vacuum under the piston, which was thus forced downwards by atmospheric pressure. The piston-rod and pump-rod were connected to opposite ends of a beam pivoted at its centre, so that the descent of the piston of the engine raised the piston of the pump. In 1759 James Watt began to improve this very inefficient arrangement. He provided a separate vessel in which the steam was condensed, thus saving the steam needed to heat the walls of the cylinder at each stroke, and applied the pressure of the steam to lift the piston. He further increased

the power of his engine by admitting steam alternately to both sides of the piston, and provided an air-pump to remove any uncondensed gases from the condenser. He also introduced the crank for converting the reciprocating motion of the piston-rod into a rotary motion, and the centrifugal governor for regulating the supply of steam so as to give an approximately constant speed. The general arrangement of the essential parts of a modern steam-engine are shown in the figure. Steam is admitted into the valve-chest, which is a closed box secured to one side of the cylinder, with both ends of which it communicates by means of two pipes or steam-ports SP. An exhaust-pipe EP is also provided, and these three openings in the side of the valve-chest—which is here made perfectly flat and smooth—are uncovered or connected together by a sliding valve SV, which is an iron box open at one side, this open side fitting on the face of the valve-chest. The cylinder C is an iron tube carefully bored out and closed at each end by cylinder-covers; it is provided with a piston P, to which is secured a piston-rod PR, capable of sliding through a central hole in one cover. Leakage of steam past the piston is prevented by metallic rings fitting in a groove in the piston and forced outwards by springs, so as to be always in contact with the wall of the cylinder. The piston-rod works through a stuffing-box, which is a short tube packed with hemp or asbestos, and provided with a screw cover to compress this packing against the rod and prevent escape of steam. The arrangement of the connecting-rod and crank will be evident from the diagram. The motion of the slide-valve is produced by an eccentric-pulley E secured to the crank-shaft. A ring fitting this pulley is attached to the eccentric-rod, which is jointed to the valve-rod. The latter passes through a stuffing-box in the valve-chest, and is fixed to the valve. When the various parts are in the position shown, steam which is supplied to the valve-chest can pass into the end A of the cylinder, while the other end is in communication with the exhaust-pipe EP. The pressure in the A end will therefore be approximately the same as that in the boiler—say 80 lbs. per square inch—while that in the B end will either be the atmospheric pressure, or, if a condenser is used, will be, say, 12 lbs. per square inch less than that. These pressures will cause the piston to move from A to B, and the crank-shaft will be turned in the direction shown by the arrows. The eccentric turns with the crank, and it is evident from their relative positions that the slide-valve will now be moving in a direction opposite to that of the piston, and that the result of this will be that as the piston nears the end of its stroke both ports SP will be closed, thus shutting off the supply of steam. When the crank has moved 90° from the position shown, any pressure on the piston can of course produce no rotation; but the fly-wheel, which is always secured to the shaft, has sufficient momentum to continue the motion, and when the crank has turned a few degrees farther, the slide-valve will have moved sufficiently far to open the port connecting the B end of the cylinder with the steam-chest and to connect the A end with the

exhaust. The piston will then be forced towards the A end of the cylinder, and at the end of the stroke the steam will be again shut off, and the whole cycle of operations will be repeated. In order to obtain economy, it is necessary that the steam should be exhausted (either into the air or into the condenser) at as nearly as possible the atmospheric pressure. The steam is therefore not admitted into the cylinder during the whole of the stroke, but is cut off when the piston has performed a portion of its movement, and this fraction of a cylinder-full of steam expands and gives up its energy during the rest of the stroke. The exhaust-port also must be closed rather before the end of the stroke, so that the compression of the steam behind the piston may cause it to be stopped gradually. If a heavy and rapidly-moving piston were stopped suddenly, an injurious jar would result. A simple slide-valve may be made to perform these somewhat complicated functions by being correctly

pencil by means of a system of multiplying levers, and draws a line on a piece of paper wrapped round a small drum. A string wound on this drum is connected to the piston-rod of the engine, so that a reciprocating rotary motion is given to the cylinder of paper which is similar to the motion of the piston. In this way the pencil draws a curve the axes of which are respectively proportional to the pressure on the piston and to the distance it has moved. The area of this curve is thus proportional to the work done on the piston, and from it it is easy to find the average pressure on the piston. If we multiply this average pressure (in pounds per square inch) by the area of the piston in square inches, we get the total mean pressure on the piston; and this, multiplied by the distance travelled by the piston (in feet) per revolution and by the number of revolutions per minute, gives us the number of foot-pounds of work done per minute; and this, divided by 33,000, is the *indicated* horse-



STEAM-ENGINE.

proportioned; but a second valve, operated by a separate eccentric, is often added to enable the steam to be cut off more exactly at the proper moment. Other valve-motions have also been devised to enable the ports to be suddenly opened to their full extent, in order to avoid the loss of pressure which results from forcing the steam through a partly opened port. Very high steam pressures are now used for large engines; and as it is found impracticable, when working at 150 or 200 lbs. per square inch, to sufficiently expand the steam in one cylinder, compound engines have been designed. In these a fraction—say one-half of a cylinder-full of steam—is admitted into a cylinder, and, after expansion, is exhausted, not into the air or the condenser, but into a second cylinder of larger diameter, where it is further expanded, and is in some cases exhausted into a third or even a fourth cylinder before passing into the condenser. In order to ascertain the power developed by a steam-engine it is necessary to know the mean pressure in the cylinder, which is of course quite different from that in the boiler. An *indicator* is used for this purpose, which consists of a cylinder provided with a piston, usually of half a square inch area. This is connected with the engine cylinder by means of a short pipe, and the pressure pushes up the indicator piston against a spiral spring. If the force needed to stretch or compress the spring is known, the motion of the piston is a measure of the pressure. The piston moves a

power. This is, of course, somewhat greater than the actual available power, as some portion of it is used in overcoming the friction of the moving parts of the engine. The indicator diagram is also of great utility for showing whether the valves are or are not properly adjusted.

Steam-Hammer is a tool largely used in ironworks for “shingling” or removing slag from the puddled ball and for making iron or steel into blooms, billets, etc., and for many other purposes. A cylinder similar to that of a steam-engine is secured in an upright position to a very substantial iron or steel frame, and to the piston-rod, which projects from the lower cylinder-cover, is attached a heavy block of iron or tup, working in guides. The tup carries the hammer-block, which can be removed for repairs when its face becomes worn, and immediately beneath this is the anvil-block. By means of suitable valves steam is admitted under the piston and raises it, together with the tup; steam being then admitted to the upper side of the piston, the hammer falls both by its own weight and by the pressure of the steam. By regulating the steam pressure and also by throttling the exhaust the force of the blow may be accurately adjusted. The weight of the piston-rod and tup may be anything up to 100 tons.

Steam-Pump. [VACUUM-PUMP.]

Stearin. Most of the natural animal fats contain, together with *palmitin* and *olein*, a

substance closely resembling the former, which is known as *stearin*. It consists of a compound of glycerine with *stearic acid*, and by the action of an acid or superheated steam may be decomposed into these two constituents. The acid itself may be so obtained as small waxy-looking leaflets which melt at 62° C. It possesses the composition $C_{18}H_{36}O_2$, being a member of the group of compounds known as the fatty acids. The *stearin candles* do not consist of stearin itself, but of a mixture of this stearic acid with the closely allied palmitic acid.

Steatite (known also by the names of *soap stone* and *French chalk*) consists of a silicate of magnesium, $Mg_3Si_4O_{12}$. It is a white or coloured mineral with a peculiar soapy feel, and occurs in Cornwall and in various Swedish and American localities. It is used for a variety of purposes—*e.g.* as a lubricant and polishing powder, for drawing or marking on fabrics or glass, for cleaning silk, leather, etc., while its addition in the manufacture of porcelain has been found to improve the appearance of the product.

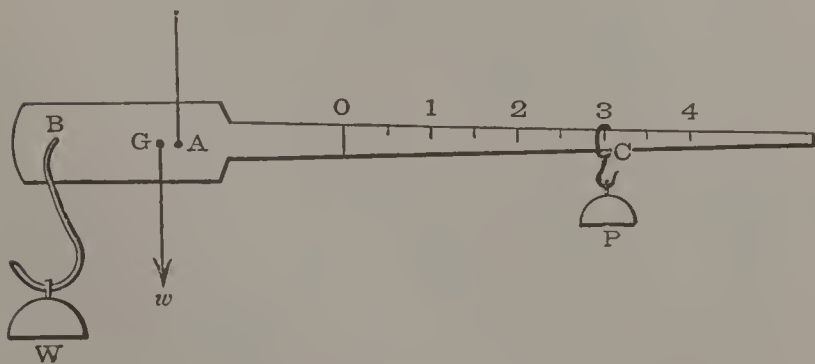
Steel is a compound or mixture of iron and carbon containing from 0.1 to 1.25 per cent. of the latter, as well as small quantities of other bodies such as silicon, sulphur, phosphorus, manganese, etc. It has not been satisfactorily determined whether the carbon is combined with or dissolved in the iron, but it does not exist in steel as free graphite, as it does in cast- or pig-iron. Steel is superior to iron in tensile strength, elasticity, and rigidity, and is so in a greater degree as the proportion of carbon is increased. The presence of phosphorus in quantities exceeding 0.1 per cent. causes steel to be hard and brittle, or "cold-short"; more than about 0.05 per cent. of sulphur makes the metal "red-short" or brittle, and unworkable at a red heat. Silicon produces a like effect if 0.5 per cent. is present; other impurities produce similar undesirable properties; but sometimes other metals, as chromium and tungsten, are alloyed with steel for special purposes. The harder kinds of steel, containing 0.5 per cent. of carbon and upwards, undergo a molecular change when heated to redness and suddenly cooled, with the result that they are hardened. Mild steels containing a little carbon are hardly (if at all) affected by this process, while those containing 0.1 per cent. of carbon may readily be rendered sufficiently hard to scratch glass. As steel when very hard is also brittle, cutting tools, springs, etc., are "let down" or softened to the required extent by being again heated and cooled. The amount of this annealing depends upon the temperature of the second heating, which is ascertained by noting the colour assumed by the film of oxide which is formed on the polished metal. The mild grades of steel are used for rails, girders, shipbuilding, and other purposes for which wrought-iron was previously employed. If the percentage of carbon is less than about 0.3 such steels can be welded. Steel can be made by smelting a pure iron ore with charcoal, but this process cannot be used in the case of the ordinary impure ores. The conversion of cast- into

wrought-iron by puddling involves the removal of most of these impurities, and the highest class of steel is made by adding carbon to Swedish malleable iron by the cementation process (q.v.). In this process bars of the pure iron are subjected to an intense heat for a prolonged period, in contact with charcoal, and carbon is gradually absorbed. As the carburisation is not uniform, this "blister" steel is frequently converted into cast-steel by melting in crucibles, so that a general distribution of carbon is obtained. In the Bessemer and basic processes (q.v.) the carbon and impurities present in cast-iron are burnt by a current of air forced through the molten metal, or are absorbed by the slag which floats on its surface, and in this way tolerably pure iron is obtained. The requisite quantity of carbon is then added in the form of spiegeleisen or ferro-manganese, which are compounds of carbon, iron, and manganese. In making open-hearth or Siemens-Martin steel, wrought-iron or scrap steel is dissolved in melted pig-iron in the regenerative furnaces, and in some cases iron ore is substituted for the scrap. Steel may also be produced by a process of puddling very similar to that employed for making malleable iron. There are several difficulties in obtaining sound castings of steel due to the liberation of occluded gases, which produce cavities, and to other causes. The most satisfactory method of obviating this is to compress the metal into the mould while still molten by heavy hydraulic pressure; but this process is necessarily expensive, and so can only be used for the highest class of work.

Steele, SIR RICHARD, was born in Dublin, probably in 1672. His father, said to have been a lawyer, died before the boy was five years old, and little is known of his mother. In 1684 he was sent to the Charterhouse School, where he formed a lifelong friendship with Addison, and in 1689 he went, with an exhibition, to Christchurch. In 1691 he was elected to a Postmastership at Merton College, but did not remain to take his degree. He enlisted as a private in the Guards, a step which cost him the succession to an estate. His conduct at this time was irregular, but his deepening sense of the seriousness of life led him to publish in 1701 his *Christian Hero*, a treatise so solemn that he felt it "encumbent on him to enliven his character" by writing a comedy, *The Funeral; or, Grief à la Mode*. In 1703 followed *The Lying Lover; or, The Ladies' Friendship*, which, he said, was "damned for its piety." Two years later he was more successful with *The Tender Husband; or, The Accomplished Fools*, after which he abandoned the stage until 1722, when he brought out *The Conscious Lovers*. In 1705 he married Mrs. Stretch, a wealthy widow, who died soon afterwards. He next began to receive favours at Court. He became Gentleman-in-Waiting to Prince George of Denmark, Gazetteer, and Commissioner of Stamps. Perhaps it was in consequence of his connection with the official organ of news that he formed the idea of a periodical containing essays on social and literary subjects, which he carried out in *The Tatler* (1709–11) under the name, already made famous by Swift, of

"Isaac Bickerstaff, Esq." The paper was published thrice a week, and in it he soon received the help of Addison, who also worked with him on the daily paper which succeeded it, *The Spectator* (1711-12). The other ventures of Steele in journalism were *The Guardian* (1713), *The Englishman*, *The Lover*, *The Reader*, *Town Talk*, and *The Tea Table*. Meanwhile, in 1707 he had married the comfort and plague of his life, Mary Scurlock, the beloved "Prue" of his love-letters. Although he had a large income, he was always in debt, and yet he maintained his independence, for he resigned his Commissionership when, in the last year of Anne's reign, he entered Parliament as member for Stockbridge with the determination to oppose the Government on the questions of the fortifications of Dunkirk and the Protestant succession. In consequence of paragraphs he had written, he was deprived of his seat by a vote of the Commons, a step which led to *Mr. Steele's Apology for Himself and His Writings*. The accession of George I. brought to him more than he had lost. He became member for Boroughbridge and Deputy-Lieutenant for Middlesex, and was knighted. He was also appointed Surveyor of the Royal Stables, Supervisor of Drury Lane theatre, and one of the Commissioners for the estates forfeited in the insurrection of 1715. He lost his wife in 1718, and in 1723 he withdrew in bad health into the country. He died at Carmarthen on September 1, 1729. His essays live through the kindly humour and subtle insight into character which they everywhere display.

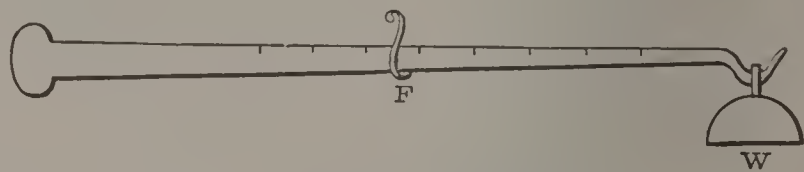
Steelyard is a balance whose arms are unequal, the same being used to weigh different substances by placing it at different distances from the fulcrum. Let the beam be supported at the point A, while its weight w acts at C. The weight P is moved until at a point O it exactly balances the weight of the beam above. A 1 lb. weight is now attached to the beam, and its weight acts downwards at B. P is moved till balance is obtained, and its position marked 1 lb. Points 2, 3, 4, etc., are then marked on the beam at distances apart equal to O 1. That equal distances along the arm correspond to equal additions of weight to w is seen from the following considerations: If P at a point C just balances w , we have equilibrium, and consequently the moments of



COMMON STEELYARD.

w and w about A just neutralise the moment of P about A. Hence $W \times AB + w \times Ab = P \times AC = P \times (AO + OC)$. But the point O is such that $W \times AG = P \times OA$, hence $W \times AB = P \times OC$.

But AB and P are fixed, so that OC varies directly with w . Hence the distance from O at which P must be placed when the weight is 2 lbs. is just twice what it must be for 1 lb., and so on. The Danish steelyard consists of a beam with a heavy lump at one end and a hook for the weight at the other. The substance is weighed by altering the position of the fulcrum (F) till equilibrium



DANISH STEELYARD.

obtains. The arm is graduated by hanging weights of 1, 2, 3, etc., lbs. at the end, and marking the position of F. The distances representing equal differences of weight are not equal in this form of the steelyard, so the subdivisions are not so easily estimated.

Steen, JAN (1636-89), Dutch painter, was born at Leyden, and ranks among the best of his school, his works being now highly esteemed. He studied under Van Goyen, whose daughter he married, and the scanty details known of his life prove it to have been a very discreditable one. He became an innkeeper, and practically drank himself to death. As a painter, he was an admirable humorist.

Steeplechase, a horse-race across country, where hedges or hurdles and ditches or streams or trenches containing water have to be crossed, the course being marked out by flags. Originally the competitors had to reach a specified goal (perhaps guided by a steeple) as best they could.

Steeple-jack, a mason or bricklayer who ascends steeples or tall chimneys to execute repairs or to fix or remove scaffolding.

Steevens, GEORGE (1736-1800), Shakespearian scholar, was born in Stepney, and received his education at Kingston and at Cambridge. He was of well-to-do family, his father being a director of the East India Company, and he was thus enabled to gratify his literary tastes to the full. He made a particular study of Shakespeare's works and times, and in 1766 issued twenty of the plays in four volumes, in which his great knowledge of early English literature was evinced. He contributed largely to various popular compilations of the day. He was on very bad terms with his contemporaries, being of an envious and most unamiable nature.

Steganophthalmata, or "NAKED-EYED MEDUSÆ," a synonym for Acraspeda (q.v.).

Stein, HEINRICH FRIEDRICH KARL, BARON VON (1757-1831). Prussian statesman, was born in Nassau and studied in Göttingen, after which he entered the civil service and rapidly rose to a high position. In 1797 he was made president of the Westphalian Chambers, and in 1804 entered the Ministry. He resigned in 1806, owing to a slight misunderstanding, but was shortly after called upon

to accept the office of Prime Minister. His success in that capacity and his zeal for reform did not please Napoleon, who procured his retirement for a short period. He advocated compulsory conscription and the abolition of serfdom, and did much to promote equality among the people. In 1812 he was of great assistance to the Emperor Alexander at St. Petersburg, his firmness and discretion being strongly marked. He did not approve of the Peace of Paris, and went into private life. His *Correspondence* is a most important work.

Steinbok, a name for the Ibex. [GOAT.] Used also of a small South African antelope (*Antilope tragulus*).

Stele, the axial cylinder of tissue arising from one strand of plerome or axial generating-tissue, in which the vascular tissue originates. Most stems have one such cylinder, and are *monostelic*; but *polystely*, or the possession of several such cylinders, is frequent among Pteridophyta (q.v.). The primitive stele may break up into several *schizosteles*, as in the stem of *Equisetum*, the Nymphaeaceæ, etc., and in many leaves. The portion of the stele given off to a leaf is termed the *meristele*. The stelar tissue, whether united or schizostelic, is marked off from the extra-stelar ground-tissue by the endodermis. The stele may contain one or many vascular bundles.

Stem, the ascending portion of the axis of a plant, bearing leaves as lateral appendages. In the Thallophyta there cannot be said to be either stem or leaf, and in higher plants, as in the case of the liverwort, or even the duckweeds (*Lemna*), the stem is sometimes represented by a flat, green, cellular, and very unstem-like expansion. Stems differ from roots (i) in growing generally upward, away—that is, from the centre of gravity; (ii) in growing at the apex without any cap of dead cells, though this growing-point is generally overlapped by rudimentary leaves forming a terminal bud; (iii) in bearing leaves as lateral appendages differing from themselves in structure; and (iv) in giving off their branches exogenously—i.e. from more superficial layers of tissue than roots do. Stems may grow horizontally, but even then commonly bend upward at their growing points, whilst even drooping branches generally take an ascending direction as they first leave the stem.

The functions of a stem are: (i) to support the leaves and flowers, and connect the former with the roots, the other main organs for taking in food; (ii) when still young and green, to assimilate, like the leaves; and (iii), more especially in perennials, to act as a food reservoir. The physiological utility of branching stems would seem to be the exposure of leaves and flowers to as much air and light as possible; and it is in stem-structures that many of the processes not only of food-transfer from assimilating organs to growing parts take place, but also those of food “elaboration.”

In the higher plants the stem originates in the plumule of the embryo, and as the stem elongates it remains terminated by a similar bud, as long as growth continues. The lower leaves of the bud, as

it now develops into a *shoot*, become separated in succession, the points at which they spring from the stem being termed *nodes*, and the lengths of stem between them, *internodes*. Some plants, such as the primrose, are misleadingly called *acaulescent*, or stemless, because their stems are so short and the internodes so little developed that the leaves are crowded together in a rosette.

The stems of the great groups of the higher plants differ markedly in internal structure. Those of mosses are mainly cellular, with an ill-defined epidermis without stomata, and the mere rudiment of a central vascular axis. Those of ferns, known as *aerogenous*, have very short internodes, and are covered with the scars of fallen leaves: they are generally cylindric, crowned with a circle of leaves and seldom branched; and, in addition to cortical and other sclerenchyma, have a circle of closed fibro-vascular bundles surrounding a soft mass of fundamental tissue, and sending out branch bundles into the leaves. Monocotyledons have stems also mostly cylindric and unbranched, with no separable bark, and hardest near the outside. They may have a distinct epidermis and primary cortex, and contain numerous scattered closed bundles which bend inwards from the roots and outwards into the leaves. There are, however, several modifications of this type. Grasses, of which the Bamboos are gigantic tropical representatives, have mostly hollow internodes with straight bundles, which intercross at the nodes. Such a stem is called *fistular*, and sometimes a *culm*. The unbranched stem of a palm or a tree-fern is called a *caudex*. Most Monocotyledons have a considerable amount of sclerenchymatous conjunctive tissue round their bundles. Some few arborescent Liliaceæ, such as *Aloë* and *Dracæna*, develop additional bundles in a merismatic pericycle.

All Dicotyledons have at first, as annuals always retain, a succulent herbaceous stem, with a distinct epidermis, and generally a green hypoderm. In woody plants, mostly perennial, the epidermis is soon thrown off and replaced by the periderm, beneath which will be the phellogen and phellogen, the central medulla shrivels, and the bulk of the stem is made up of the ring of open fibro-vascular bundles, separated by the medullary rays, and made up of annual rings of xylem within and of phloem outside the line of cambium.

If a woody plant has one main stem at least ten or twelve feet high it is called a *tree*; whilst if it branches freely near the ground it is a *shrub*.

Though usually round in section, the stem is sometimes angular; being triangular, for example, in sedges, and square in many Labiatae. In other cases the leaves are, so to speak, continued down the sides of the stem, which is then termed *winged*, as in some thistles. In surface the stem may be smooth, or, technically, *glabrous*; furrowed, hairy, downy, bristly or *setose*, that is, having stiff hairs; or prickly, as in the rose.

In duration stems may be annual, biennial, or perennial; but a large number of plants known as *herbaceous perennials* have perennial underground stems, but send up branches above ground that are annual, dying down each winter.

Other forms of aërial stem, such as the runner, the offset, the sucker, the thorn, some tendrils, and the phylloclade, together with most forms of underground stem, such as the rhizome, corm, bulb, and tuber, have mostly been separately described.

Steno, NICHOLAS (1638–1687), anatomist, was born at Copenhagen, and was one of the pupils of Bartholin. He travelled in Germany, France, and Italy, and became a Catholic. He was appointed Professor of Anatomy at Copenhagen, but finally entered the Church, and was made a bishop by Innocent XII. He published several great works on anatomy, notably his *Observations on the Muscles and Glands* and *The Anatomy of the Brain*.

Stephanite is an ore of silver consisting of a compound of that metal with sulphur and antimony. It forms clear bright-red crystals, and occurs chiefly on the Hartz, at Freiberg, and in Norway and Hungary; but is found to a smaller extent in most silver ore deposits.

Stephanotis, a small genus of Asclepiadaceæ, natives of Madagascar, consisting of climbing shrubs with leathery leaves and umbels of beautiful fragrant salver-shaped flowers, which are largely cultivated in stoves for their beauty.

Stephen, SIR JAMES FITZJAMES (1829–94), English jurist, graduated at Cambridge and was called to the Bar in 1854. In 1868 he became a Q.C., and from 1869 to 1872 was a legal member of the council of the Indian Government. In 1875 he was made Professor of Common Law in the Inns of Court, and resigned it in 1879 on being appointed Judge of the High Court. He was a very great lawyer, and his works on law are amongst the most valuable ever published. His most notable work on *The Common Law of England* appeared in 1863, and the following should also be mentioned: *Essays by a Barrister* (1862), *Liberty, Equality, and Fraternity* (1873), *Digest of the Law of Evidence* (1876), *Digest of the Criminal Law* (1877), and *History of the Criminal Law of England* (1883).

Stephen, LESLIE (b. 1832), English critic, graduated at Cambridge, like his brother, Sir James Stephen, and gave his attention to literature, producing some admirable works, such as the three series of *Hours in a Library* (1874–79), *History of English Thought in the 18th Century* (1876), *The Science of Ethics* (1882), and *Lives of Henry Fawcett, Johnson, Pope, and Swift*.

Stephen, KING (1104–54), was the son of the Count of Blois, by a daughter of William the Conqueror. On the death of Henry I. he claimed the English Crown, and succeeded in obtaining and holding it by bribery and other nefarious methods. The Scots harassed him greatly, but they were finally defeated at the Battle of the Standard, and by the aid of his brother, the Bishop of Winchester, he managed to reign during his comparatively short career, and, after a disastrous battle with Henry's daughter and son, Gloucester, it was agreed that Henry Plantagenet should succeed him.

Stephens, HENRY (1528–98), English name for the great French printer and scholar, born in Paris, and the son of Robert Stephens (1503–59), whose true name was Etienne. Robert was an eminent scholar, and began to print about 1525, and issued a large number of learned works, many of which were edited by himself. Perhaps his most famous productions are his editions of the Bible, for which he was persecuted and driven from France by the narrow-minded doctors of the Sorbonne. He favoured the Reformation, and settled in Geneva. His most notable innovation was his division of the Bible into chapter and verse, now universally adopted. Henry Stephens, his son above mentioned, devoted himself chiefly to the classical authors, and issued magnificent editions of Homer, Terence, Plato, Xenophon, Æschylus, Herodotus, and other Greek writers. His greatest work is, however, his valuable philological study, *Thesaurus Linguae Græcæ*, which appeared in five folio volumes in 1572.

Stephens, JAMES (b. 1820), Fenian leader, was born in Kilkenny, and began life as a civil engineer. When the rebellion of 1848 broke out, he threw himself into it with enthusiasm, and was wounded at the Ballingarry episode. He escaped to Paris, where he lived for some years, and returned in 1858 to start the Fenian movement in conjunction with O'Donovan Rossa and others. He was the acknowledged head of the conspiracy, which made alarming progress, and founded a paper in connection with it. This was seized and Stephens and others were arrested. He escaped in a remarkable manner and fled to Paris, while the rest were sentenced to long terms of penal servitude. He supported himself in Paris by teaching English, and by his translations of Dickens into French, and was allowed to return to Dublin a year or two ago.

Stephenson, GEORGE (1781–1848), great engineer, was the son of a collier, and was born on Tyneside. He worked in the mines from childhood, and gradually worked himself up to the position of brakesman, where his inventive genius soon began to show itself. He made some small improvements in the working of the horse engine, meanwhile educating himself as well as he could, and trying his hand at the adjustment of mechanical contrivances. In 1815 he invented a useful safety lamp, for which he was presented with 1,000 guineas at a public banquet in Newcastle. Previously he had thought over the possibility of constructing a locomotive, and in 1814 made a trial of one at Killingworth. Though a very simple affair it worked well, and in the following two years he made others, each being an improvement on the preceding. His fame extended, and he was appointed manager of the Hilton Colliery Railway, where his engines were used. The speed of his early engines was from six to eight miles an hour, and when his famous "Rocket" attained a speed of twenty-nine miles an hour, great wonder was expressed. Stephenson's latter years were exceedingly prosperous—a succession of triumphs. His son, ROBERT STEPHENSON (1803–59), was even a greater engineer than his father, who gave him an

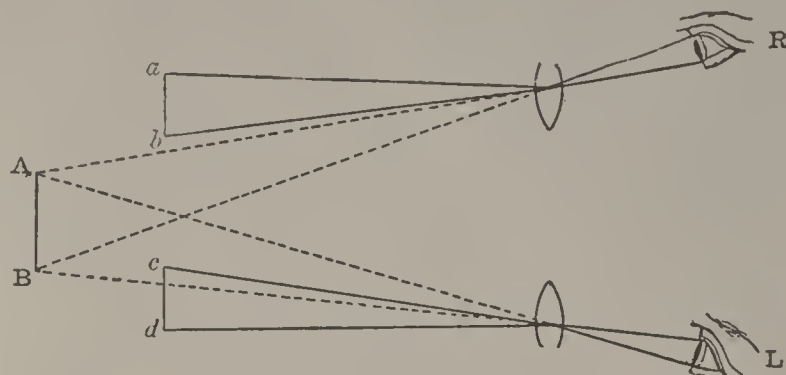
excellent education, sending him finally to Edinburgh University. He was apprenticed to his father in 1822, and soon outrivalled the latter in his mechanical ingenuity, constructing the "Planet," which has proved the model of the engine of to-day. He carried out many grand undertakings in England, and was consulted by various foreign countries, from which he received many honours. Besides his remarkable feats of engine-making, he constructed many bridges which are marvels of engineering. His achievements are too numerous to mention. In 1847 he became M.P. for Whitby. He was a most generous benefactor to public institutions.

Steppes, large tracts of land in Asiatic and European Russia, characterised by a total absence of trees.

Stereom, the collective name for all the tissue, whether sclerenchyma or collenchyma, which serves as mechanically supporting tissue to the various parts of plants. Collenchyma often serves this purpose in leaf-stalks and herbaceous stems. As illustrating the varied disposition of the stereom, mention may be made of the variously scattered strands of sclerenchyma in the ground-tissue of fern-stems; of the circle of numerous crescentic strands in the cortex of *Arum maculatum*; of the continuous pericyclic ring in *Allium vineale* (the crow garlic); of the hypodermal and conjunctive strands in the hollow stem of *Juncus glaucus*, one of the rushes; and of the sheath of conjunctive stereom general in monocotyledonous stems. [HISTOLOGY, VEGETABLE TISSUES.]

Stereoscope. Since our two eyes are separated by a definite distance, it follows that near objects will produce slightly different images on the two retina. The two pictures are mentally blended, and the combination gives us the perception of solidity or relief. Wheatstone was the first to point out the importance of this double vision, and illustrated its effect by means of an instrument he called a stereoscope, which was afterwards improved by Brewster. Two pictures are drawn of an object from two near but different points of view. They represent the pictures formed by the two eyes. The one picture will show a little more of the right side of the object, just as would be seen by the right eye; the other picture will show more of the left side. The two pictures are then placed in two halves of a box, over each of which a half lens is placed. The right eye views the one picture, while the left eye sees the other, a partition down the centre of the box preventing either eye seeing what was intended only for the other. The two half-lenses slightly magnify the picture, and, what is more important, cause the two virtual images to coincide as nearly as possible. Thus, rays from the object *ab* to the lens enter the eye R as though they came from A B. In a similar way the other lens forms an image of *ed* which appears to the eye L to be superposed upon A B. The result is that the observer sees a solid object instead of a plane picture. The whole thing stands out in relief and looks exactly like

any actual still dimensional object. The inability of a person to detect which eye sees an object is exhibited by the stereoscope. A piece of white



STEREOSCOPE.

paper may be put in one side, and a paper with a dot on it in the other; the observer cannot tell in which side the dot occurs—*i.e.* he does not know which eye sees it.

Stereotype, a duplicate face in one piece of a quantity of type set up for printing. The plate is produced by taking a mould in plaster, clay, or papier maché and running metal into it, or by the electrotype (q.v.) process.

Sterling, JOHN (1806–44), poet and critic, was the son of Edward Sterling, a native of Waterford, who received the appellation of "The Thunderer" whilst editing the *Times*. He was born in Scotland, and, after completing his studies at Glasgow and Cambridge in 1827, became a journalist. For a time he edited the *Athenæum*, and was a disciple and friend of Coleridge and Wordsworth, whose influence is discernible in his writings. He wrote frequently for periodicals, and proved himself an excellent thinker. He married in 1830, and from the state of his health was obliged to go to St. Vincent for a couple of years. In 1839 appeared his *Poems*, and in 1843 his tragedy of *Strafford*. He became a curate under Archdeacon Hare, who afterwards collected his works, and died prematurely and much regretted. He was a close friend of Carlyle, who has immortalised him in his *Life of Sterling* (1851).

Sterne, LAURENCE (1713–68), author of *Tristram Shandy*, was the son of an army officer, and was born at Clonmel, Co. Tipperary, where his father was stationed. He was the grandson of an archbishop, and of very good family. His mother was a native of Clonmel. He was sent to Cambridge University for his education, and graduated M.A. there in 1740. He was ordained, and received through his uncle, the Rev. Dr. Sterne, a living at Sutton, to which was added subsequently a prebend at York. He also obtained later the rectory of Stillington and the curacy of Coxwold, where he lived for some years quietly enough. His wit was maturing slowly, and few of his neighbours were aware of his possession of that unique quality of humour which he afterwards shed profusely in all his works. Occasionally, however, his sermons approached levity, and were sometimes marked by that suggestiveness which is peculiar to him. His only humorous production of this period was a

work entitled *The History of a Watch Coat*, a satire on a voracious church dignitary at York. The year 1759 is notable as the date of publication of the first two volumes of his *Tristram Shandy*. The work immediately attracted much attention, and was praised and blamed in all directions. Its grossness shocked many, its extraordinary humour and feeling delighted others, and its art of discursiveness created surprise everywhere. Emboldened by the success of the first two volumes, Sterne went on with the work, producing a couple of volumes now and again, till the completion of the work in 1767. In 1768 he issued his *Sentimental Journey*, which won instant popularity, and made even more admirers than *Tristram Shandy*. It has remained a classic to this day, and though not free from grossness, it is less diffuse, and contains many exquisite touches. A host of imitators of Sterne have arisen in England, France, and Germany, but they rarely reach the height of Sterne at his best. His *Sermons*, which were published before his *Sentimental Journey*, whatever their faults may be, are at least not dull or heavy. Many biographies of Sterne have been written, that by Leslie Stephen being perhaps the best.

Sternhold, THOMAS (d. 1549), first verse translator of the Psalms, was born in Hampshire, and became an Oxford graduate. During his life, of which little is known, he held some important offices, including that of Groom of the Robes to Henry VIII. and Edward VI. In 1548 he issued, in conjunction with Hopkins, his version of the Psalms, and this has been often reprinted. It is the only work which has handed down Sternhold's name.

Sternum. [SKELETON, RIBS.]

Stethoscope, the instrument employed in auscultation of the chest. [AUSCULTATION.] The stethoscope consists of a perforated cylinder expanded at either end—on the one hand for adaptation to the ear of the observer, on the other for application to the chest-wall of the patient. It is usually made of wood. Of late years the binaural stethoscope has been largely used, such an instrument being applied to both ears of the auscultator, and the sounds from the chest examined being conducted by flexible indiarubber tubes.

Stettin, the capital of Pomerania, and the second in size of the Baltic seaports of the German Empire, stands on the left bank of the Oder at its mouth in the Stettiner Haf, which, with an area of 200 square miles, affords safe anchorage for all the navies of the world, but is rather shallow. Swinemünde, at the entrance to the Haf, has deeper water. During the last twenty years Stettin has become a very important naval station, possessing an arsenal, docks, building-sheds, forges, and a school of navigation, and being strongly fortified. There are also factories for machinery, cement, soap, and chemicals. Several bridges connect the town with the suburb of Lastadie across the river.

Stevens, GEORGE ALEXANDER (1720–1784), comedian and author, was born in London, and

went on the stage, travelling with companies for some time without success. He next began to write for the stage, with little more profit; but at length, by his public entertainment called *A Lecture on Heads*, a whimsical address being delivered each time he appeared, he became famous. He also published *Comic and Satirical Songs* (1772) and *The History of Tom Fool* (1760). Towards the end he fell into poverty and imbecility. His *Lecture* was published in 1799.

Stevenson, ROBERT LOUIS (b. 1850), novelist, was born in Edinburgh, and was originally intended for the profession of engineering, with which his ancestors had been connected for generations. He studied at Edinburgh University, and was called to the Bar, where he was unsuccessful. Turning his attention to literature, he soon gave signs of the remarkable genius now universally recognised. His works are numerous, and the exquisite style in which they are written is almost their chiefest merit. Among them may be mentioned his *Travels with a Donkey* (1879), *Virginibus Puerisque* (1881), *New Arabian Nights* (1882), *Treasure Island* (1883), *The Strange Case of Dr. Jekyll and Mr. Hyde* (1885), and *Kidnapped* (1886). His latest novels, *The Wreckers* and *The Master of Ballantrae*, show no falling off in power.

Stewart, BALFOUR, F.R.S., LL.D. (1828–1887), physicist, was born in Edinburgh, and followed a commercial career with some success for a few years. His attention was diverted to magnetism, and he pursued its study with great perseverance, obtaining several important posts as his acquirements became more fully appreciated. He made some useful discoveries in magnetism and heat, and obtained the Rumford medal. His text-books on those subjects are held in much estimation.

Stewart, DUGALD (1753–1828), Scottish philosophical writer, was born in Edinburgh, where his father was professor of mathematics at the University. Entering that of Glasgow in 1771, he returned in the following year, and occupied his father's post as a deputy. Philosophy was, however, his chief study, and in 1778 he was temporarily appointed to the chair of moral philosophy at Edinburgh, and again in 1785, remaining in the position till 1810. His lectures gained him much fame, and he discussed political economy as well as his own subject proper. The first volume of his admirable *Elements of the Philosophy of the Human Mind* appeared in 1792, the second in 1814, the third in 1826. Other works of his deserving of record are his *Account of the Life and Writings of Adam Smith* (1793) and his *Philosophical Essays* (1810). His complete works were edited by Sir William Hamilton. He was not a very original philosopher, but he did useful work in exposing the weak points in the philosophy of Locke, Berkeley, and Hume.

Stewart, HOUSE OF, a noble Scottish family which has filled a large place in history. The founder of the royal line was a Walter Stuart, or Stewart, who married a daughter of Robert Bruce. He was supposed to be descended from Banquo,

Thane of Lochaber, who was killed by Macbeth. The name is derived from the word "steward," or "seneschal," a position held by one of the early Stuarts under Malcolm. The son of Walter Stuart and Marjory Bruce was ROBERT II. (1316-1390), who carried on several wars with England, and was succeeded by his son, ROBERT III. (q.v.). The next king was JAMES I., who was murdered in 1437, and after whom there were several undistinguished monarchs of the same family, until JAMES V., who ascended the throne in 1513, and is chiefly known, perhaps, as the father of Mary Queen of Scots (q.v.), whose unfortunate career has been the subject of endless controversy, one section regarding her as an angel, while another has painted her as a heartless monster. Her son, the feeble and vain JAMES VI. of Scotland and I. of England, was better known as a poet than in any other way. His son, JAMES II. of England, was the last Stewart king, and was succeeded by William of Orange after the disastrous Battle of the Boyne, to which disaster James's cowardice largely contributed. His son JAMES was known as the "Old Pretender," and was born in 1688 and died in 1735. CHARLES EDWARD, the "Young Pretender," his son, is immortalised by his heroism, and is the theme of numberless Scotch songs.

Stickleback, any fish of the spiny-finned genus *Gasterosteus*, with some ten species, from the North Temperate and Arctic zones. They are of small size, and have the first dorsal fin replaced by spines, and bony plates along the sides. All are nest-builders, and in the breeding season the males are brilliantly coloured. The Three-spined Stickleback (*G. aculeatus*) is exceedingly common in Britain. The Fifteen-spined Stickleback (*G. spinachia*) is marine, but the freshwater forms can live in brackish and even in salt water.

Stilbene (C₁₄H₁₂) is prepared by the action of sodium on benzoic aldehyde. It is insoluble in water, soluble in boiling alcohol, melts at 115° and boils at 306°.

Stilicho, FLAVIUS (d. 408 A.D.), Roman general, was probably a Vandal, and in early life saw service in the Roman army. His skill and tact were speedily recognised, and his successful negotiation of a treaty with the King of Persia in 384 led to his receiving the favourite niece of the Emperor Theodosius in marriage. He was appointed guardian of the sons of Theodosius on the latter's death, and received high commands and other honours. He was thwarted in his ambition by Rufinus, whom he caused to be murdered, but he gained great victories over Alaric and his Goths, whom he twice chased out of Italy. Honorius, the son of Theodosius, finally suspected him of treachery and ordered his assassination. The wife of Stilicho was afterwards put to death.

Still is the apparatus used for distilling any liquid. It consists of a boiler (often of copper) in which is placed the liquid whose vapour is required. From the neck of the boiler leads a long tube, called the worm; this is generally coiled into a

compact form, and kept in a vessel known as the refrigerator, through which cold water is constantly flowing. The vapour, rising into the neck of the boiler, becomes condensed in the cooled worm, and flows from a tube at the bottom of the worm into the receiver. Stills used for distilling different liquids vary in details, but the principle of all is the same.

Stillingfleet, EDWARD (1635-1699), Bishop of Worcester, was born in Dorsetshire, and took his degree at Cambridge. After he was ordained he received a living at Sutton, and while there published his *Irenicum*, a work which he subsequently retracted to some extent. At the Restoration he was given several valuable preferments, and on the accession of William III. was appointed to the see of Worcester. He was engaged during most of his life in strong controversy with the Catholics and Dissenters, and wrote many works against them. His two chief works are his *Origines Sacrae*, or a *Rational Account of the Christian Faith*, and his erudite history of the British Church, *Origines Britannicae*.

Stilt, any bird of the genus *Himantopus* of the Snipe family. These birds owe their name to their long legs. *H. candidus*, about thirteen inches long, with black and white plumage, is a summer visitor.

Stimulants, drugs which excite the activity of various organs of the body, mainly by the effect they produce on the central nervous system or on local nerve centres. Alcohol, carbonate of ammonia, ether, camphor, etc., are familiar examples of stimulant drugs. According to the particular part of the body they are designed to affect, stimulants are sometimes classified as cerebral, cardiac, circulatory, gastric, hepatic, and respiratory stimulants, and the like.

Sting-ray, any Ray of the family Trygonidae, in which the tail bears a long barbed spine, representing the dorsal fin, and capable of inflicting a severe wound, difficult to heal, owing to the mucous secretion from the skin. There are several species, one of which (*T. pastinaca*), the Fire-flare, is British.

Stinkstone, a name applied to those limestones which, from the presence of either bituminous matter or sulphuretted hydrogen, have a fetid odour, especially when freshly broken. The Carboniferous Limestone of some parts of Ireland even imparts this odour to well and spring water.

Stinkwood, a valuable South African timber, the product of *Ocotea bullata*, a member of the order Lauraceae, which grows fifty or sixty feet high, and four or five feet in diameter. The wood is said to be almost equal to teak for durability and strength, but has become scarce from former reckless destruction of forests. It varies in colour from white almost to black.

Stipule, a basal appendage sometimes present in leaves. They are almost invariably in pairs and are most frequent among Dicotyledons. When they are present the leaf is *stipulate*; when absent, *exstipulate*. The stipules are commonly *leafy*, and

are exceptionally large in cases where the blade of the leaf is reduced, as in many tendril-bearing Leguminosæ. They are rarely associated with a leaf-sheath; but are so in the rose. They often serve as bud-scales, as in the alder, oak, beech, and linden, and they are then generally membranous and deciduous. In most acacias they are represented by spines, and in *Smilax* (q.v.) by tendrils (q.v.). Various cases of union occur among leafy stipules. They may cohere by their outer margins,



STIRLING CASTLE.

(From a Photograph by G. W. Wilson and Co., Aberdeen.)

as in *Astragalus*, and are then termed *opposite*, as they form a leaf-like structure opposite their leaf; or they may cohere by their inner margins, as in *Melianthus*, when they are termed *axillary*; or by both margins, as in the Polygonaceæ, when they are called *ocreate*, forming a tubular sheath round the internode. When the leaves are two or more in a whorl, stipules may cohere, forming *interpetiolar* stipules, as in *Galium Cruciatum* and in the epicalyx of the Strawberry. Compound leaves sometimes have stipules below each leaflet, which are termed *stipels*.

Stirling, a county of Scotland occupying an area of about 466 square miles between the Firths of Forth and Clyde, with Perth and the Forth N., Loch Lomond W., Dumbarton and Lanark S., Clackmannan and Linlithgow E. Mountainous in the N.W., where Ben Lomond attains a height of over 3,000 feet, it has rich alluvial valleys, the "carse" along the Forth being specially fertile. There are barren moors and bogs in parts. The Carron, the Bannockburn, the Endrick, and the Kelvin are the chief rivers, and, besides part of Loch Lomond, Lochs Coulter and Elrigg are within the limits of the county. Coal and iron abound, and are worked on a large scale at Carron and Falkirk. The building stone of Campsie is in

much demand. Woollen goods, calico prints, and chemicals are among the chief manufactures. The capital, Stirling, stands on the rocky shore of the Forth, 31 miles N.W. of Edinburgh, dominated by the stately castle which dates from the 12th century, and contains the parliament hall of James III., the palace of James V., the royal chapel, and many interesting buildings, having served frequently as a residence for the Scotch kings before the Union. Grey Friars' Church is another remarkable 13th

century monument, and Cambuskenneth Abbey on the other side of the river ranks among the most beautiful ruins in the North. The town has played a great part in Scotch history, and has stood many sieges. Monk took it in 1651, and it successfully resisted the Highlanders in 1745. Woollen goods, such as carpets, tartans, and shawls, now form the staple industries, the former cotton trade having died out. It returns one member to Parliament.

Stirling, JAMES HUTCHISON (b. 1820), metaphysician, was born at Glasgow and studied in the university of his native town. He is the most eminent of the older English or Scotch Hegelians, his *Secret of Hegel* (1865) being a masterly exposition of the system. Among his other works are a criticism of *Sir William Hamilton* (1865), an attack on Darwin and Hux-

ley, entitled *As Regards Protoplasm* (1869), and a *Text-book to Kant* (1881). His translation of Schwegler's *History of Philosophy* is a useful handbook.

Stitch, a sharp pain in the side, usually due to muscular affection, but sometimes caused by more deep-seated trouble, particularly by involvement of the pleural surfaces by inflammatory mischief.

Stitchwort, the name applied, owing to their thread-like stalks, to several members of the genus *Stellaria*, which belongs to the Caryophyllaceæ. Their white petals are two cleft; they have ten stamens, three styles, and a capsule opening in six valves. *S. Holostea*, the Greater Stitchwort, Satin-flower, Adder's-meal, Cuckoo-flower, or Gowk's-meal, with grass-like leaves and large flowers, is one of the ornaments of our Spring hedgerows.

Stoat. [ERMINE.]

Stock (*Matthiola*), a genus of Cruciferae with a nearly cylindrical silique and numerous thin flat seeds in one row. There are about 30 species, 13 of which are European and 2 British. *M. incana*, wild on the shores of the Isle of Wight, is the origin of the "Queen" stocks in our gardens. *M. sinuata* occurs on the west coast. *M. annua* is the Ten-week stock; *M. græca*, the smooth-leaved

annual stock; and *M. tristis*, with small brown flowers, the night-scented stock.

Stockbroker. [STOCK EXCHANGE.]

Stock Exchange, "THE LONDON, is a voluntary association of those who deal in the various securities which pass by the common name of stocks and shares. It has not enjoyed a single legal privilege, yet it has thriven, and the public have neglected more than one effort to establish an open market to resort to it for business and to give it exclusive confidence." It is actually a Proprietary Company, dating back from the end of the last century, when business was conducted in the Rotunda of the Bank of England and in a coffee-house in Threadneedle Street, to which the public were admitted. In 1801, however, a site in Capel Court was acquired and a building erected, which was opened in 1802 with some 500 subscribers. A code of regulations was printed in 1812, and, with numerous additions and modifications to suit altered conditions, exists at the present day. The administration of the Stock Exchange, or "The House," as it is familiarly called, is vested in (1) the Managers, representing the shareholders in the company as a joint-stock undertaking, and (2) the Committee for General Purposes, representing the general body of subscribers. This committee consists of 30 members, including a chairman and deputy-chairman; it controls the business of the House, modifies the code of rules and regulations, or frames new ones as may be necessary, and adjusts disputes between members, or even between members and non-members when the latter desire it. Every year in March the committee proceeds to elect or re-elect all members for the year next ensuing, after which it is itself reconstituted. Few changes, however, actually occur, save such as are due to death or withdrawal from business. The subscribers now number some 3,400, and these alone (and such of their clerks as are "admitted") have the right of entry. They are divided into two classes: (1) Dealers or Jobbers, who act as middlemen, and devote their attention severally to particular classes of securities in which they deal, thus forming various groups or "markets" in the House; and (2) Brokers, who act as intermediaries between the public and the jobbers. This distinction does not hold good for the provincial markets, in which only brokers are found. The general business of the Stock Exchange consists in the buying and selling of securities, of which the principal are English, Colonial, and Foreign Government stocks, and the stocks and shares of railways, banks, and industrial concerns, embracing all joint-stock companies. Transactions are, in the great majority of cases, made for settlement on the "account-day" next succeeding, two of such days being appointed by the committee every month, one about the middle and the other at the end. Transactions in English and Indian Government stocks, however, are made either for "cash" or for the "consol" settlement, which takes place once a month. An "official list" is published daily, showing the nominal quotation of all the principal securities dealt in, and the prices at which

"bargains" have actually been done on that day. It will be seen that the London Stock Exchange thus supplies a very real need of the present day, offering to the public a ready means of buying or selling securities at current market prices.

Stockholm, the capital of Sweden, was founded in the 13th century upon three islands at the junction of the Mälär Lake and the Baltic. Many of the houses are built on piles, and the numerous canals have won for the place the designation of "the Northern Venice." Staden, the old city, occupies an islet in the main channel, and affords space for the fine royal palace, filled with treasures of art. Here is the centre of commerce. To the W. lies Riddarholmen with the Houses of Parliament, to the E. Blasieholmen, Skeppsholmen, and Castellholmen, chiefly occupied by quays and offices connected with the admiralty and mercantile navy. The fashionable quarter of the city extends over a large tract to the N. of the Staden, and is called Normalmen, the suburb of Ladugardslandet, with its park (Humlegården), barracks, military school, and royal library, being E. of this. Södermalmen, where the working classes chiefly reside, stands S. of Staden, being separated from it by a canal. Stockholm was only adopted as the capital in the 17th century. It is the seat of seven academies, but has no university, and is ecclesiastically subordinate to Upsala.

Stockport, a municipal and parliamentary (two members) borough, on the borders of Cheshire and Lancashire, occupies a commanding site on the Mersey 6 miles S.E. of Manchester. A Norman castle existed here, and the place grew to some size before the Civil War, but its present prosperity is entirely due to the cotton-mills and felt factories established about a hundred years ago. All the churches and public buildings are modern, but the grammar school, rebuilt by the Goldsmiths' Company, was founded in 1487. Cobden, who represented the borough in Parliament, has a monument in St. Peter's Square.

Stockton, the county town of San Joaquin county, California, United States of America, stands 48 miles S.E. of Sacramento on the Central Pacific Railway, and commands the trade of the San Joaquin valley, having canal communication with the San Joaquin river. Though founded only in 1849, it is a large and important settlement.

Stockton-on-Tees, an old municipal and parliamentary borough of Durham, stands on the N. bank of the Tees near its mouth, and 11 miles distant N.E. from Darlington. Though dating from Roman times, and boasting until recently the ruins of a mediæval castle, the place only began to attain prosperity towards the middle of this century through the growth of the iron and steel trade. The port does a large trade in shipping coal to the South and to the Baltic, and, in addition to blast-furnaces, iron-foundries, and steel-works, there are large building-sheds, sail-cloth factories, potteries, and breweries.

Stoics, a sect of philosophers of ancient Greece, founded by Zeno of Elea, who taught in the *Stoa*

Pocile (Στοὰ ποικίλη), or "Painted Colonnade" of the Agora at Athens. They inculcated the pursuit of active virtue as the supreme good, with complete repression of all passions and emotions. They explained the universe by a materialistic pantheism, heat or fire being the actuating and divine principle. Though nominally maintaining human freedom, they made it consist only in conscious submission to the universal reign of law in nature, and were in fact strict "determinists." [CHRYSIPPUS, CLEANTHES, ANTONINUS.]

Stoke-on-Trent, the chief centre of the "Potteries," stands 15 miles N. of Stafford on the river Trent, the Trent and Mersey Canal, and the London and North-Western and North Staffordshire Railways. It is connected with Burslem and other places by steam trams. Its prosperity is entirely due to the development of the manufacture of earthenware within the last sixty years, though there are also iron-works. It was incorporated in 1874, and now returns one member to Parliament.

Stokes, SIR GEORGE GABRIEL (b. 1819), was born at Skreen, county Sligo, and educated at Cambridge, where he became Lucasian Professor of Mathematics in 1849. He was secretary of the Royal Society (1854-85) and President (1885-90). He was elected Conservative member for Cambridge in 1887. His investigations in hydrodynamics, the theory of light, and other departments of mathematical physics, have given a great stimulus to scientific inquiry.

Stole, in the Latin, Eastern, and Anglican Churches, a strip of silk or other fabric (originally linen) worn by ecclesiastics. Priests and bishops wear it with the middle at the back of the neck, and the ends pendant in front, save that a celebrant priest in the Latin Church has the ends crossed over the breast and secured under his girdle. The stole is widened and fringed at the ends, and frequently has a cross embroidered on the middle and the ends. Deacons wear the stole over the left shoulder, tied on the right side.

Stomach. [DIGESTION.] *Diseases of the Stomach: Gastritis*. Inflammation of the mucous membrane of the stomach may be due to the ingestion of poisonous or irritant substances or of unwholesome food, or to abuse of alcohol; and may occur in association with diseases of other organs, particularly of the heart and liver. The chief symptoms of ordinary chronic gastric catarrh are pain, with tenderness on pressure, foul and coated tongue, headache, flatulence, nausea, slight rise of temperature, and disturbance of the bowels. Treatment consists mainly in regulation of the diet and in the administration of tonic remedies; it is, of course, of primary importance to deal with the cause of the malady, if it can be ascertained. (The subject of *indigestion* is dealt with under that head.) *Ulcer of the Stomach*. A disease which is much more common in women than in men; it is often associated with a condition of anæmia. The symptoms of the disease are ordinary dyspeptic troubles and more particularly pain, which comes on a short time after taking food, and which is usually followed by attacks of vomiting, the vomit

in most instances at one or other period of the disease containing blood (hæmatemesis). In cases of gastric ulcer there is always the risk of perforation, with escape of the contents of the stomach into the peritoneal cavity; should this event occur, sudden pain and collapse, followed by peritonitis, supervene. Regulation of diet is the main item in the treatment of the disease, and when anæmia is present the appropriate remedies for that condition are administered. Subnitrate of bismuth is a drug of considerable value in relieving the pain and vomiting. *Cancer of the stomach* usually affects the pyloric end of the viscus, and is commonly of the variety known as scirrhus; the chief symptoms are vomiting, digestive troubles, wasting, and the presence of a tumour which can be felt through the abdominal wall. For vomiting of blood, see HÆMATEMESIS.

Stomate, a transpiration-pore in the epidermis of the sporophyte in the higher plants. It is an aperture surrounded by two cells termed *guard-cells*, which retain their protoplasm and chlorophyll and change in form so as to open or close the aperture. The aperture communicates with a large intercellular space within the epidermis. The guard-cells result from the division of a single epidermal cell, and are cuticularised on their outer surfaces. Stomates occur on the "capsule" of mosses, on fern-fronds, and on most sub-aerial parts of flowering plants. They are absent from roots and submerged structures, and are generally few in number on the upper surface of dorsiventral leaves. On the under surface there may be as many as 600 to the square millimetre. Similar but larger and immobile guard-cells flank an aperture known as a *water-stomate* on some leaves, by which water from a vascular bundle is exuded, as in *Tropæolum*, *Alchemilla*, some aroids, and many saxifrages. The term "stomate" has been wrongly extended to the large pores of totally different origin on the thallus of the liverworts. The opening and closing of a true stomate is effected by an increased or diminished curvature of the guard-cells, the result, it would seem, of their assimilative processes.

Stomatopoda, an order of Crustacea, including the genus *Squilla* or the Locust Shrimps. The order is characterised by the possession of a short cephalothoracic shield, or plate, protecting the anterior part of the body. The abdomen is large, and the branchiæ or gills occur on the bases of the limbs beneath it. The shell is generally thin and flexible. They are all marine; the earliest form which is certainly referable to this order occurs in the Jurassic.

Stone. [CALCULUS, LITHOTOMY, LITHOTRITY.]

Stone is a weight which is nearly out of date, although it has—with different values—been used in many countries. The legal British stone is 14 lb., but various trades have used values of the stone vastly differing in amount—*e.g.* 8 lb. for meat, 16 lb. for cheese, etc.

Stone Circles are unhewn standing stones, or menhirs, disposed in a ring. For a long time these prehistoric monuments were erroneously associated

with Druidical worship, and in many instances they still figure in local guide-books as "Druidical remains." It is now certain that, in most cases at any rate, their chief purpose was the enclosure of a piece of ground in which interments took place. This conclusion has been arrived at from the result of excavations; and these show that the ground enclosed by many of the stone circles of Scotland was, in prehistoric times, a burial-place; and from the relics found in the tombs uncovered it appears that they belong to the Bronze Age. When the body was cremated, as was usually the case, the ashes were put into a hole in the ground and covered with an inverted funeral urn, though sometimes this protection was not afforded. The bodies that were buried without cremation were deposited in stone cysts. Hence it appears that these stone circles answered precisely the same purpose as the walls of the burial-places of the present day. At any rate, this was their chief purpose. And since the chambered cairn of New Grange, in Ireland, was surrounded by a stone circle, and as the stone circles of Scandinavia have also been shown by excavation to enclose burial-places, it seems probable that the circle at Avebury is of the same character, though some hold that it was erected to mark the spot on which the last Arthurian battle was fought. The same conclusion may be, in all probability, applied to the smaller, but more famous, circle at Stonehenge. At the same time something is to be said for the view that connects these megalithic monuments with the religion of vanished races, especially when it is remembered that in India at the present day menhirs are objects of veneration.

Stonechat (*Saxicola rubicola*), a fairly common British bird of the Thrush family. The male is about five inches long, in his summer plumage the upper parts are black and brown, with some white on the wings, and the lower part ruddy. These birds feed on insects, worms, and seeds.

Stonecrop, a name applied to most of the species of the genus *Sedum*. This genus of 120 species, of which forty-four are European and eight or nine are British, comprises fleshy plants, mostly small, with cymes of yellow, white, or purple star-like pentamerous flowers, with ten stamens and five carpels forming follicles. They grow on rocks, walls, sand, and other dry situations, the most common, *S. acre*, being a small plant with densely imbricate leaves and golden flowers, sometimes called "wall-pepper."

Stonehaven, the county town of Kincardineshire, nearly 20 miles S.W. of Aberdeen. It does a considerable fishing trade.

Stonehenge (Saxon, *Stan*, stone, and *hangian*, to hang or support), an ancient monument of Druidical or Keltic origin, which stands upon Salisbury Plain, two miles from Amesbury, Wilts. It consists of an outer circle, 300 feet in circumference, composed of upright stones 16 to 22 feet high and 18 feet round, upon the tops of which are laid blocks of similar size, so as to form a series of continuous square arches. Within these, at a distance of nine feet, is a circle of smaller monoliths

having no imposts. This ring encloses two ovals, the larger of which consisted of five pairs of trilithons, rising in height from E. to W., the smaller comprising nineteen tapering monoliths, whilst in the centre of the whole system lies an altar slab 15 feet long. A ditch enclosed the entire work, which was approached by an avenue in which stands a cromlech known as the Friar's Heel. Antiquarians variously fix the date of its construction between the 1st century B.C. and the 5th century A.D., and there is reason to believe that the structure had an astronomical significance as well as a religious use.

Stone-Whorls. [SPINDLE-WHORLS.]

Stone-Worship, a general name for worship paid to unhewn stones, as the dwelling-places or representatives of deities. The best collection of facts about stone-worship will be found in Tylor's *Primitive Culture*.

Stonyhurst, a noble Elizabethan mansion, picturesquely situated in Ribblesdale, about seven miles from Blackburn, Lancashire. Founded by Sir Richard Sherburne, it passed, towards the end of the last century, to the Weld family, who in 1794 leased the place to Jesuit fathers from Liège for the establishment of an English Roman Catholic College. Large additions have since been made to the house, and it is now the most important educational institution of its kind in this country, claiming to be the Eton of the Catholic community.

Storax is a member of the group of substances known as *balsams*, and is obtained as a thick brown liquid from incisions in the bark of *Liquidambar orientalis*. It possesses a peculiar sweet odour, and consists chiefly of *cinnamic acid* together with certain derived compounds and a hydro-carbon C_8H_8 known as *styrolene*, and is used as a source of this latter compound and of the cinnamic acid. It is used in perfumery and is also employed to a small extent medicinally, as an expectorant, and in the form of an ointment, as a detergent. About 10 tons are exported annually from Smyrna. It was formerly obtained from *Styrax officinale*.

Stork, any individual of the family Ciconiidae, chiefly confined to the eastern hemisphere. These birds are heron-like in form, but of stouter build and with longer bills, and the claw of the middle toe is not serrated. Their favourite resort is in marshy land or near river-banks, and they feed on frogs, snakes, lizards, fish and fish-fry, small mammals, young birds, and insects. The True Storks belong to the type-genus *Ciconia*, of which there are six species widely distributed. The best known is the Common or White Stork (*C. alba*), fairly plentiful in some parts of Europe, especially in Holland and North Germany. It figures largely in the folk-tales of these countries, and is the heraldic emblem of piety and gratitude. The total length is rather more than 40 inches. The body, head, and neck are white, the wings black, and the legs and bill red. In their northward migration in the spring storks range as far as Scandinavia, and sometimes visit Britain. The return journey to Africa is made in autumn. The Black Stork (*C.*

niger), with black plumage above and white below, has strayed to Britain.

Storms are atmospheric disturbances accompanied by continuous variety in the direction and force of the wind, and generally covering an elliptical or circular area. The overlapping of several storms sometimes occurs, the resultant storm spreading over an area of very irregular shape. The normal tendency to the circular form is, however, of great use in predictions of storms at sea and in weather forecasts. The area visited by a storm may vary from about 1,000 to 5,000 square miles. The direction in which a storm travels is probably controlled by the generally prevailing winds, with modifications introduced by irregularity of the countries over which it passes, and by the occurrence of large expanses of water. In Europe a storm always has some easterly component, although it may vary between N.E. and S.E. On a few occasions when a storm has started in a westerly direction it has ultimately changed and followed an eastern course. In the Mediterranean Sea the storms are changeable in direction and confined to small areas; in the West Indies and in India they often trace out a parabolic path. The want of a sufficient number of meteorological observatories has prevented the deduction and verification of the laws governing the behaviour of storms, and the connection of the storms in different parts of the world is but very imperfectly understood. On the approach of a storm the barometer falls, clouds form, and the temperature rises, till rain announces the proximity of the storm's nucleus. The rain increases till the storm's centre has passed by, when its violence subsides, the temperature is lowered, and the clouds are dispersed. The rate at which storms proceed varies in different parts of the earth. An average of seventeen miles an hour has been deduced from European storms, twenty-eight for those in North America; while around India the speed is as low as nine miles an hour, and often much less. Certain storms have been known whose velocity was over seventy miles an hour, but such high speed is very rare. It was noted that low pressures precede storms, and it has been found that in the northern hemisphere winds circle round the points of lowest pressure in a direction contrary to the hands of a clock, while in the southern hemisphere their direction is clockwise. As well as this circular direction, however, there is some slight radial inclination towards the centre. The circular direction in which the winds blow has been proved to be connected with the rotation of the earth on its axis, and hence their origin may be compared with that of the trade-winds. The violence of the storm is naturally greater where the wind is strongest, and the violence of the wind depends on the difference of pressures of the places between which the wind is blowing. If there is great difference of pressure between near places, there is great force of wind, and the storm is intensified. Hence the arrangement of lines of equal pressure (or isobars) at any time determines the wind and weather at that time, and since the direction of the wind enormously affects

the character of the season, it is at once seen how important a factor is the knowledge of the distribution of barometrical pressure in weather forecasts.

Storthing, the national Parliament of Norway.

Story, JOSEPH (1799–1845), American jurist, born in Massachusetts, was appointed Associate Justice of the Supreme Court of the United States in 1811, and held the post till his death. In 1829 he became law professor at Harvard. He wrote a *Commentary on the Constitution of the United States* (1833) and other important legal treatises.

Stothard, THOMAS, R.A. (1755–1834), designer, was the son of an innkeeper in Long Acre. Having attracted attention by his plates for the *Town and Country Magazine* and the *Novelists' Library*, he became a student of the Royal Academy in 1778. His illustrations of *The Pilgrim's Progress* and Rogers's *Poems* are among his happiest efforts. He was also a painter of great merit.

Stow, JOHN (1525–1605), an eminent antiquary, born in London. His chief work was his *Survey of London* (1598). During his closing years he suffered much from poverty.

Strabismus, or SQUINT, is the condition in which the visual axes of the two eyes are not both directed to the same point when an object is fixed by the patient. The squint may be *convergent* or *divergent*. In the former case, the eye whose visual axis is not directed towards the object is deflected towards the nose; in the latter case it is, on the other hand, deflected outwards. The most common form of squint is the convergent squint which is met with in association with hypermetropia. In this form of strabismus there is no paralysis of any muscle, and it is often the case that either eye is indifferently used by the patient for fixing an object, the squint in that case being termed "alternating" or "concomitant." In most instances, however, after a while the patient acquires the habit of always fixing objects with one eye; the squint is then said to be "fixed" in the other eye. The power of seeing objects with this latter becomes increasingly impaired, and, if the squint remains unrelieved, the eye in which the squint is "fixed" ultimately becomes a blind eye. The cause of the association between hypermetropia and convergent strabismus has already been dealt with. [EYE, ERRORS OF REFRACTION.] Divergent squint is often associated with short sight, and unlike convergent squint there is commonly a serious impairment of the power of vision from the outset; indeed, the eye whose visual axis becomes deflected outwards is an eye, as a rule, which the subject of the squint never uses in fixing objects by reason of its defective vision. Paralytic squint may be met with altogether apart from errors of refraction, as a result of brain disease involving the nerve structures which are concerned with the movements of the ocular muscles.

In paralytic squint "diplopia" or double vision is usually present, the images of any object to which the patient directs his gaze falling upon parts of the retinae of the two eyes which do not correspond. This diplopia is often very distressing to the patient.

It might have been anticipated that double vision would have also been present in the ordinary concomitant squint, but this is not the case as a rule, the subjects of this latter form of squint being rarely troubled with diplopia—a fact which is otherwise expressed by saying they are able to “suppress” the visual image transmitted from the squinting eye. The operation for squint consists in dividing the tendon of one of the ocular muscles; thus, in the case of concomitant squint, the tendon of the internal rectus of one or both eyes is divided with a view to placing the muscle at a disadvantage as compared with the opposing muscles and so obviating its exaggerated action. In some instances, in addition to putting back the attachment of the muscle which is too active, it is necessary to advance the attachment of the opposing muscle. The importance of dealing with the common convergent strabismus of children in its early stages cannot be insisted upon too strongly. Indeed, in some instances the use of appropriate glasses from the time of appearance of the squint is effectual in remedying the condition without making it needful to resort to operation at all.

Strabo (b. *circa* 63 B.C.), a celebrated geographer, was born at Amasia in Pontus. His mother belonged to a Greek family. He received his early education at Nysa in Caria, and at Rome, and it was probably in the latter city that he continued his studies under the philosopher Xenarchus. The remainder of his life was devoted entirely to travel. He says of himself: “I have journeyed westwards from Armenia to the parts of Etruria opposite Sardinia; towards the south from the Euxine to the borders of Ethiopia; and perhaps no writer of geographies has visited more places than I have between these limits.” Besides the physical characteristics and natural productions of the countries described, the *Geography* discusses the race, life, manners, and trade of the inhabitants, with some historical digression. It is based both on his own observations and the works of Eratosthenes, Polybius, and other Greek writers. There are seventeen books, the fourth of which is devoted to Gaul, Britain, and Ireland.

Stradella, ALESSANDRO, a singer, musical performer and composer of the 17th century, whose works did much to raise the standard of Italian taste. Little is known concerning the details of his life. It is said that he eloped from Venice with Ortensia, the wife of a nobleman who had befriended him, and that after many perilous escapes the two were murdered at Genoa by assassins sent to track their steps. On one occasion, at Rome, his life had been saved through the effect produced by his great oratorio, *San Giovanni Battista*, on the assassins who were waiting for him at the church door. He also composed sonatas, cantatas, etc.

Strafford, THOMAS WENTWORTH, EARL OF (1593–1641), English statesman, was the son of Sir William Wentworth, of Wentworth Woodhouse in Yorkshire. After studying at Cambridge he entered Parliament in 1614, but took no active part in politics till 1621. From that date he endeavoured to maintain the liberties of the people without

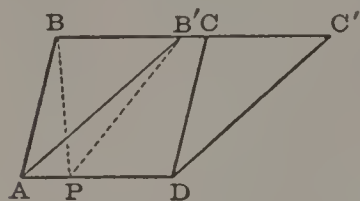
infringing the authority of the Crown, till the crisis of 1629 drove him to sacrifice his love of freedom to his loyalty. His decision was perhaps hastened by his recent appointment to the presidency of the Council of the North with the title of Baron Wentworth. He now proceeded to carry out that policy of “thorough” by which he sought to establish a just and strong Government with the sovereign as coping-stone of the political fabric. The period during which he governed Ireland as Lord Deputy (1633–40) was one of unwonted social and material progress, but his harsh proceedings increased the existing disaffection, and helped to bring about the rising in 1641. In January, 1640, he was created Earl of Strafford and Lord-Lieutenant of Ireland. He was now the king's most trusted counsellor, and was rightly regarded as responsible, above all others, for his arbitrary policy. Immediately after the meeting of the Long Parliament he was impeached of high treason, the form of accusation being subsequently turned into a bill of attainder. After the bill had passed both Houses Charles very reluctantly gave it the royal assent, and on May 12th Strafford was executed on Tower Hill.

Strain and Stress. Stress is an action between two bodies. If a spring be held in a stretched position by a body, there is a pull of the spring on the body, and an equal and opposite pull of the body on the spring. As long as things remain in that condition this mutual pull produces no effect, and is known as a stress; but if one end of the spring be released or the object removed, motion at once ensues. This motion is the result of a certain force, and the stress is numerically equal to this force, which is also numerically equal to either the action of, or reaction on, the spring. The direction of this force is, of course, in the line of the action and reaction, but it may be in either direction, according to the circumstances which allow it to act. This force is sometimes known by the misleading name of “total stress,” but stress is actually the *force divided by the area* over which it acts; this quotient (force per unit area) is sometimes also badly named the “intensity of the stress.” If a spring be attached to a point at one end and allowed to hang with, say, a piece of metal at the other, the stress will be simply the weight of that piece of metal divided by the sectional area of the spring, and will be the same if we remove the piece of metal and fix that end of the spring in the same position. The action of such a stress causes the body to be altered in length or in some other way—it produces, in fact, a deformation, and this deformation is properly known as *strain*. In the case of the stretched spring the strain is shown as increased length, and is measured as the ratio of the increase in the length to the original unchanged length. The ratio $\frac{\text{stress}}{\text{strain}}$, or, in the case

of the stretching of a line or a spring,

$$\frac{\text{force per unit area}}{\text{elongation per unit length}},$$
 is known as Young's modulus of elasticity. A body may be distorted by a *shearing* stress, and

such a distortion is called a shearing strain. Let $A D$ and $B C$ be two parallel layers of a body in its original position, and let the body be distorted so that $B C$ assumes the position $B' C'$, all intermediate parallel layers taking up corresponding sheared positions. If $B P$ be drawn perpendicular to these parallel layers the angle through which it moves is $B P B'$, and the shearing strain is measured by the tangent of this angle, or



STRAIN AND STRESS.

$\frac{B B'}{B P}$. The shearing strain

is of importance in the case of liquids, and is one of the factors entering into the measurement of viscosity (q.v.).

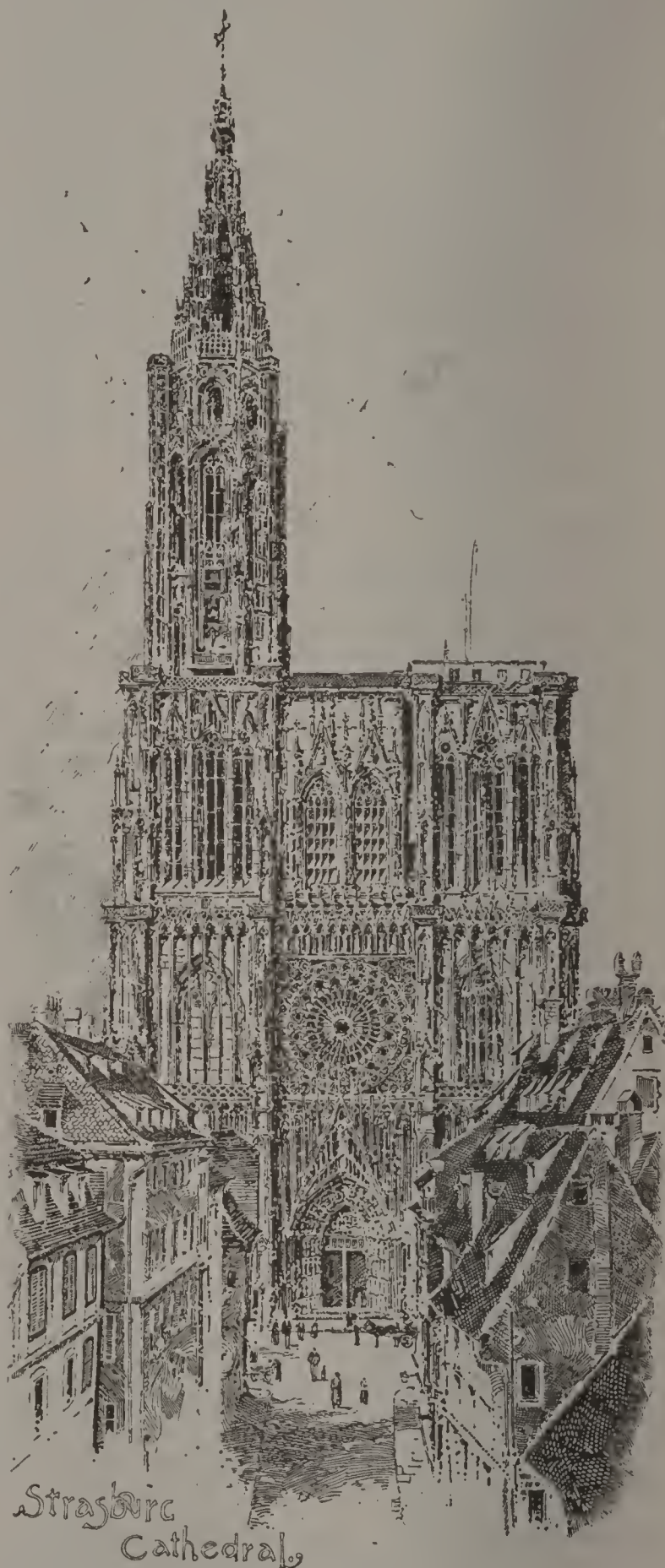
Straits Settlements, THE, include the British possessions on the west coast of the Malay Peninsula, and some native states under the protection of the British Government, comprising in all about 25,000 square miles, of which the Straits Settlements proper occupy 1,472 square miles. These latter consist of Malacca, Penang, Singapore (q.v.), Wellesley Province on the Malay Peninsula, Cocos Islands on the route from Ceylon to Australia, and the Christmas Islands, and they are among the most important of Crown colonies for revenue, trade, etc. Singapore is the seat of the central Government, which is composed of a Governor, assisted by an Executive Council of eight and a Legislative Council of fifteen. The system of law is formed by the Indian Acts, and local laws based upon the law of England, and is administered by a Chief Justice and three Puisne Judges, and there are two subordinate Courts of Admiralty in the Settlements. The climate is uniform, and the vegetation evergreen, and most parts of the Colony are favourable as a residence to Europeans, but the population is principally Chinese or Malay. The exports amount to more than £140,000,000 annually, and consist chiefly of guttapercha, gambier, india-rubber, pepper, horns, hides, canes, sugar, rice, sago, tapioca, spices, tea, coffee and tobacco, while the imports exceed £150,000,000. Malacca is the largest and oldest of the Settlements, and was first taken by the Portuguese, then by the Dutch, from whom it finally passed in exchange to the English in 1824. Up to 1867 the Colony was in the hands of the Indian Government.

Strange, SIR ROBERT (1721-92), line-engraver, was born in the mainland of Orkney. He took part in the Jacobite rising of 1745, and was obliged to withdraw to France, where he studied under Le Bas at Paris. In 1750 he returned to England, and soon afterwards settled in London. During a visit to the Continent in 1760-64 he was received with high honour by the Italian academies.

Strangles, a contagious disorder which attacks horses, and which is characterised by catarrh, affecting the nose and throat with glandular swellings.

Straparola, GIOVANNI FRANCESCO, a native of Caravaggio, in Lombardy, wrote *Tredecì Piacevoli Notti* (*Thirteen Pleasant Nights*) (1550-54),

a collection of seventy-four tales supposed to be narrated under circumstances very much resembling those in the *Decameron* (q.v.), from which several of the stories are taken. Among the rest, some are of Eastern origin and some are derived from folklore. This work was the source of *Puss in Boots* and other popular fairy-tales.



Strasburg, or STRASSBURG, a German town and fortress of the first class, 1 mile from the Rhine and 250 miles S.E. of Paris, capital of the ceded

Alsace-Lorraine district. The old fortifications, designed by Vauban, were destroyed in the Franco-German War, and the town is now defended by a chain of outlying forts. Many of the houses were destroyed during the bombardment, but have been rebuilt, and are for the most part lofty, while the streets are wide and clean and the squares extensive. The river Ill and its branches are crossed by many wooden bridges. Strasburg possesses a remarkably fine 13th-century Gothic cathedral, with a spire 466 feet high, a nave 357 feet long, while the roof is 79 feet high. The west front, 230 feet high, has three portals, richly ornamented, and having above them a round window 48 feet in diameter. The astronomical self-regulating clock of Strasburg, with its figures that perform at the hour of noon, is renowned. Other buildings of note are a church, once Dominican, decorated with scenes from "The Dance of Death"; an ancient bishop's palace; the Church of St. Thomas, containing a statue of Marshal Saxe; a Jewish synagogue, the Stadthaus, Mint, Arsenal, University, Public Library, etc. The chief productions are woollen, linen and cotton goods, machinery, carpets, gloves, pâtés-de-foie-gras, chemicals; and brewing, dyeing, bleaching, tanning, ironworking, sugar-refining, and tobacco-manufacturing are also carried on. There is an extensive trade in corn, wine, hops, tobacco, and the productions above mentioned. Strasburg has an archbishop. The town—then called Argentoratum—was a stronghold of the Romans against the Germans, and then passed into the possession of the latter. In the Middle Ages it was a free town and a republic, but in 1681 it was seized in time of peace by Louis XIV., and remained French till the Franco-German War of 1870.

Stratford-on-Avon, a municipal borough and market town of Warwickshire, 88 miles W. of Warwick and 94 N.W. of London. It is beautifully situated on the Avon, which is here crossed by two bridges, one of them being of stone with fourteen pointed arches. There is a fine cruciform church, part of which dates from the early part of the 14th century, and which contains the tomb and bust of Shakespeare, who was born and died here. Other important buildings are the Free Grammar School, the Town Hall, the Guildhall, the Shakespeare Theatre, the Shakespeare Fountain, the Library, and the Picture Gallery. The town is a well-known place of pilgrimage to lovers of Shakespeare, and though the house in which he died has been destroyed, that in which he was born still exists, and is now a museum of Shakespearean relics. The town suffered much during the Civil War.

Stratford de Redcliffe, STRATFORD CANNING, VISCOUNT (1786-1880), diplomatist, was the son of Stratford Canning, a London merchant, and first cousin of George Canning. He was educated at Eton and Cambridge. He became first secretary to the Embassy at Constantinople in 1808, and Minister-plenipotentiary in 1810. As Minister-plenipotentiary in Switzerland (1814-19) he took part in arranging the federation of the cantons. After a special mission to the United States (1820) he went as ambassador to Constantinople in 1825,

and entered into those negotiations on behalf of Greece which culminated in the treaty of Adrianople (1829). Greek affairs again took him to Turkey in 1831. During his final residence in Constantinople, which lasted sixteen years (1842-58), he gained a complete hold over the Sultan, earning by his power the title of "Great Elchi." He secured important privileges for the Christian subjects of the Porte, and was extraordinarily successful in baffling Russian intrigue. Yet he was powerless to prevent the Crimean War, although his previous policy put Russia altogether in the wrong. He was created Viscount in 1851 and K.G. in 1869. After his return to England he lived in retirement, though occasionally speaking in the House of Lords on foreign policy.

Stratification, the arrangement of rocks in layers, the result of deposit. Though volcanic ashes may be stratified, and even lavas interstratified, or poured out on or between beds, stratification is mainly confined to sedimentary or aqueous rocks. Deep or open-sea deposits, or others in which the nature of the sediment continues long unvaried, are likely to be in thick beds, such as some freestones; whilst estuarine or shore deposits, laid down under the influence of changing currents, frequently vary repeatedly in composition, forming a succession of thin-bedded layers, such as Penarth beds in the Trias (q.v.), the Purbeck series, or the Woolwich beds. There is generally some absence of cohesion being two successive strata, especially if of different composition, and thus planes of bedding may form lines of passage not only for underground waters, but also in some cases for intrusive igneous rocks. Individual strata may range in thickness from an inch to many feet, and a stratum may be subdivided by planes of lamination. [SHALE.] Beds will generally be greatest in thickness and coarsest in texture near the source of the sediment, becoming finer and thinner as they recede from it; and the coarser the rock be in grain, the more local it will be, as a rule, in area. By the *thinning out* of beds of one kind the general lithological character of a series may change totally in a small horizontal distance.

Stratigraphy, or STRATIGRAPHICAL GEOLOGY, that department of geology (q.v.) which arranges the rocks, especially the sedimentary ones, in chronological succession, and endeavours to trace the sequence of physical events of which they constitute the record. It thus, to a great extent, is the summation and application of the results of the other branches of the science. In establishing the order of superposition of strata, fossils (q.v.) are of the greatest utility, each species or group of organisms increasing from its first appearance to its culminating point of abundance, and then sooner or later declining, before the absence of higher types, until it may disappear, in which case it never reappears. Thus the relative abundance of a species of genus may be of the greatest use in demarcating a *zone* or *horizon* in a thick uniform series of rocks. The Ammonites (q.v.) have been largely employed for this purpose among thick uniform series of Secondary rocks,

such as the Lias clays or the Chalk. Similarly an abrupt change in the fossils, such as that between the lower and upper parts of the Elgin Sandstone, may represent a considerable break in the succession of the rocks (in this case, between Old Red and New Red Sandstone), though there may be no marked unconformity; and, *vice versâ*, the absence of any such change may show that even a considerable local unconformity does not represent any great lapse of time. The geological record is necessarily so imperfect that, though we cannot doubt that the succession of physical events, of denudation and deposit, of depression and elevation, and of organic life on the globe, has been one continuous story, it is fairly easy to subdivide the rocks formed into successive divisions. It is proposed by the International Geological Congress to adopt the following terms for the various grades of subdivision among rocks and in the time taken to form them, beginning with the most comprehensive division:—

Group	...	...	Era, <i>e.g.</i> Mesozoic.
System	...	...	Period, <i>e.g.</i> Cretaceous.
Series	...	...	Epoch, <i>e.g.</i> Neocomian.
Stage	...	...	Age, <i>e.g.</i> Upper Neocomian.
Beds	...	...	<i>e.g.</i> Folkestone Beds.

Strauss, DAVID FRIEDRICH (1808–74), theological critic, was born at Ludwigsburg in Würtemberg. After studying at the Theological Institute of Tübingen, where the seeds of scepticism were planted in his mind by the teaching of Baur, he was ordained in 1830, and in 1831 visited Berlin to attend the lectures of Hegel and Schleiermacher. Returning to Tübingen in 1832, he devoted his time mainly to the *Leben Jesu Kritisch Bearbeitet* (*Life of Jesus Critically Examined*), the first volume of which appeared in 1835. In this work he endeavours, with profound learning, to show that the account of Jesus given by the Evangelists rests on a basis of historical fact, but that the supernatural element is due entirely to the myths which formed themselves in the minds of his followers. It marked the beginning of a new epoch in Biblical criticism. His appointment to the chair of theology at Zürich (1839) excited so much uproar that he was dismissed with a pension, but this step did not prevent the overthrow of the Government. After a brief political career in 1848, in which he disappointed his revolutionary supporters, he devoted himself entirely to literature. Of his other works the most important were *Die Christliche Glaubenslehre* (1840–41) and *Der Alte und Der Neue Glaube* (1872).

Straw, the dry stalks of certain cereals and of beans and peas, which stalks are rich in silica, and consequently of a stiff texture.

Strawberry (*Fragaria*), a small genus of rosaceous plants, comprising three or four widely-distributed species. They produce runners, have adnate stipules and, generally, ternate leaves, an epicalyx of five leaves, and a remarkable fleshy outgrowth from the floral receptacle carrying the numerous achenes with their persistent lateral styles upon it in a spiral. The fragrance of this fruit, or rather pseudocarp, and the custom of putting straw under the fruit in wet weather are the origins of its name. Strawberries were certainly cultivated

before the time of Holinshed, if not before that of Richard III. (*see* Shakespeare's *Richard III.*, act iii. scene 4), *F. vesca* being a common wild plant throughout Europe, Northern Asia, and North America. The *hautbois* (*F. elatior*), with spreading hairs on the flower-stalks and short stalks to the leaflets, sometimes found wild, is probably only a cultivated variety of *F. vesca*, which has escaped from gardens. *F. virginiana*, the scarlet or Virginian strawberry, introduced in 1629, and *F. grandiflora*, the pine strawberry, introduced from Carolina, are the origin of many of our cultivated sorts. *F. chilensis*, introduced from Chili to France in 1712, is largely grown in France, and has been used for crossing with other forms in this country. Some 700 or 800 tons of strawberries are sold in London annually, Kent being the chief centre of their cultivation for the metropolitan market.

Strength of Materials. A substance will break when it is strained beyond a given amount, and this limiting value of the strain is what is understood by the strength of the material. This strength varies with the kind of strain. A rod of metal may be pulled or crushed, the strength being often the same in both cases, or it may be twisted, in which case the substance generally breaks down sooner—*i.e.* its resistance to shearing is less than to tension. The following table gives the strength of various substances:—

SUBSTANCE.			BREAKING WEIGHT. IN LBS. PER SQ. INCH SECTION.	
Cast steel	...	...	120,000	(tension)
Wrought iron (bar)	...	...	59,000	"
Cast iron...	...	...	88,900 to 125,000	(crushing)
" "	...	...	14,800 to 16,500	(tension)
Cast copper	...	...	19,000 to 26,600	"
Copper wire may stand as much as	...	...	60,000	"
Bronze containing 12 parts copper to 1 part tin...	...	...	29,000	"
Brass containing 7 parts copper to 3½ parts zinc	...	...	32,000 to 39,000	"
Aluminium bronze containing 10 parts aluminium to 90 parts of copper	...	...	100,000	"
Aluminium bronze (rolled)	...	...	120,000	"
Timber—Beech	...	...	11,500 to 22,200	(tension)
"	...	...	9,363 to 7,733	(crushing)
Mahogany	...	...	8,000 to 21,800	(tension)
"	...	...	8,300	(crushing)
English Oak	...	...	15,000	(tension)
Teak	...	...	6,500 to 10,000	(crushing)
"	...	...	8,200 to 15,000	(tension)
"	...	...	12,100	(crushing)

Beams of the following timber 1 foot long, and supported at both ends, will just give way under the following weight, calculated for a sectional area of 1 square inch:—

Beech	...	...	...	518 to 677 lbs.
Mahogany	...	...	...	425 to 610 lbs.
Oak	...	...	...	557 to 964 lbs.
Teak	...	...	...	820 to 1,075 lbs.

Streptoneura, a division of the unsymmetrical Gastropoda, including those in which the nerve cords of the viscera are twisted. The group includes the great majority of the common univalve mollusca. It is classified as follows:—

1. ZYGobranchia: both etenidia (gills) present or aborted.
- a. CTENIDIobranchiata, *e.g.* *Haliotis* (Venus' Ear Shell) and *Fissurella* (Key-Hole Limpets).
- b. PHYLLIObranchiata: *Patellidae* (Limpets).

2. AZYGOBRANCHIA : Left ctenidia only retained.

a. REPTANTIA. Foot adapted for creeping.

1. *Holochlamys*, e.g. *Trochus* (Top Shells), *Paludina* (Pond Snail), etc.
2. *Pneumochlamys*, e.g. *Cyclostoma*.
3. *Siphonochlamys*, e.g. *Cypræa* (Cowry), *Conus* (Cone-Shells), *Buccinum* (Whelk), etc.

b. NATANTIA : Pelagic and free swimming.

1. Atlantacea.
2. Carinariacea.
3. Pterotracheacea.

Strickland, AGNES (1806–74), historian, was born at Reydon Hall, in Suffolk. Her most popular work was her *Lives of the Queens of England* (1840–49), in which she was aided by her sister Elizabeth.

Stricture, the narrowed and constricted condition which is sometimes met with in the urethra, and more rarely the œsophagus, rectum, or other natural passage of the human body. Stricture of the urethra usually occurs as a result of preceding inflammation, particularly the inflammation which is caused by gonorrhœa. It may be due, in rare instances, to injury or to ulceration of the urethral mucous membrane. The results produced by stricture of the urethra, if the condition is allowed to remain untreated for a considerable length of time, are far-reaching, and productive in the majority of instances of serious disease of the bladder and kidneys.

Strike, a line at right-angles to the dip of beds of rock—the general direction, that is, of their outcrop—along which they appear horizontal, whatever their inclination. In folded rocks the strike will generally be the axis of the fold. On a level surface strike and outcrop coincide. In mining the strike is sometimes termed the *level course* or *level bearing*. The dip being ascertained, the strike will be known; but, though the strike may be known, the dip may be to one side of it or to the other. Thus, with an easterly or a westerly dip, the strike must be north and south; but with a north and south strike the dip may be westerly or easterly. Master-joints and faults often follow the line of strike, and escarpments are worn back at right-angles to this line. [DIP, ESCARPMENT.]

Strike, a concerted abandonment of work by a body of workmen with the object of exacting concessions from their employer or employers.

Strindberg, AUGUST (b. 1849), a modern Swedish writer, born at Stockholm. His works include *The Red Room* (1879) and *The New Kingdom* (1882), social satires; *The People of Hemsö* (1887) and *Life of the Skerry-men* (1888), sketches of Swedish life, and *The Father* (1887), a drama.

Stromatoporidae, a group of extinct organisms of which the affinities have long been somewhat uncertain. There seems, however, to be little doubt that they are really Hydrozoa (q.v.), and allied to some such type as *Hydractinia* (q.v.). They form massive coral-like structures composed of calcareous layers concentrically arranged and separated by small vertical pillars. The group ranges from the Silurian to the Lias.

Strontium (Sr. 87.5) is a metallic element which, in all its chemical properties, is closely allied to the metals *barium* and *calcium*, between which

it forms, as it were, a chemical mean. It was first prepared in 1808 by Sir Humphrey Davy by the electrolysis of the fused chloride, though the probable existence of the metal had been pointed out 15 years before. The metal has a yellow colour, is malleable, and possesses a specific gravity of 2.5. It oxidises on exposure, and readily burns, while if thrown on to water it decomposes it with liberation of hydrogen. It occurs naturally chiefly in the form of sulphate (*celestine*, SrSO_4) or carbonate (*strontianite*, SrCO_3). It forms two oxides of formulæ SrO and SrO_2 , its salts corresponding to the former of these. The hydroxide, Sr(OH)_2 is only slightly soluble in cold, but more readily in hot water, the solution possessing an alkaline reaction. The chloride and nitrate are both soluble salts, the latter being very largely employed in pyrotechny, as it, in common with other salts of strontium, imparts a magnificent crimson colour to flames. The sulphate is only very slightly soluble in cold water and less soluble in hot, and may thus be precipitated from strontium salts by the addition of a solution of gypsum and boiling. The metal is readily recognised in its compounds by the flame coloration and by its very characteristic spectrum.

Strophanthus, a drug which has been extensively used of late years in the treatment of cardiac disease. It has also a diuretic action. A tincture of it is included in the British Pharmacopœia.

Struensee, JOHANN FRIEDRICH, COUNT (1737–72), Danish statesman, was born at Halle, where his father was pastor. In 1768 he was appointed personal physician to the weak-minded Christian VII. of Denmark, his ascendancy over whom became complete. He subsequently gained the favour of the young queen, Caroline Matilda, sister of George III. of England, and with her aid proceeded to reorganise the institutions and administration of the country. The undue haste with which he pressed on his reforms excited the alarm of all classes, and the queen-dowager succeeded in persuading the king that his life was in danger. The queen and Struensee confessed that they had formed a guilty connection, and the latter was put to death. Caroline was carried by an English fleet to Zelle, where she died.

Struma. [SCROFULA.]

Strychnine, an exceedingly poisonous alkaloid which occurs chiefly in the seeds of *strychnos nuxvomica* and *strychnos Ignatii* or St. Ignatius' bean. From either of these sources, usually the former, the compound is obtained by extraction with boiling dilute alcohol and treatment with various reagents to get rid of other constituents. When finally crystallised from hot alcohol, it forms four-sided bright rhombic prisms, which melt at 204° and possess a most intensely bitter taste. The compound itself is only slightly soluble in water, but it acts as a basic substance, forming salts with acids, many of which dissolve readily, and all of which are, like the strychnine itself, characterised by the bitter taste. The preparation of this alkaloid contained in the Pharmacopœia is the *Liquor strychnine hydrochloratis*, the dose of which

is about 5 minims. It acts as a tonic, stimulates the respiratory centre to increased activity, and increases the excitability of the motor centres of the spinal cord. It is hence often employed in certain diseases of the respiratory organs and in some forms of paralysis. The "Liquor" is often administered hypodermically, in doses of 1 or 2 minims, for its tonic and stimulant action on the heart, with a view to its exciting the respiratory centre. The symptoms produced, when a poisonous dose of strychnine has been taken, are muscular twitchings, culminating in violent convulsive movements. The treatment of strychnine poisoning consists in attempting to get rid of the poison, if it is not already absorbed, by emptying the stomach, and in some instances the administration of chloroform by inhalation has been practised with a successful result. When, however, the strychnine has been taken in considerable quantity, a fatal result quickly supervenes.

Stuart. [STEWART.]

Stubbs, WILLIAM (b. 1825), the great constitutional historian, was born at Knaresborough and educated at Ripon grammar school and Christ Church, Oxford. He was elected to a fellowship at Trinity, and, after long holding a college living, was appointed professor of modern history at Oxford (1866-84), and occupied the see of Chester from 1884 to 1888, when he was translated to Oxford. His *Constitutional History of England*, an epoch-making work, was published in 3 vols. between 1874 and 1878. His other works include a collection of mediæval chronicles for the Rolls Series with valuable prefaces, *Select Charters and Other Illustrations of English Constitutional History* (1870), and *Lectures on the Study of Mediæval and Modern History* (1886).

Stuffing-Boxes, contrivances for making a joint air-, water-, or steam-tight, when it is required to pass a movable rod out of a vessel or into it.

Sturdy (GID), a disease of sheep, due to the presence of a parasite, the embryonic form of one of the tapeworms.

Sturgeon, a book-name for a family (*Acipenseridae*) of cartilaginous Ganoid fishes, having five rows of bony plates on the long cylindrical body. The snout is produced, and the under-jaw bears four barbules. The tail is unsymmetrical, and the anal and dorsal fins are far back. They are found in the north temperate zone, and either live in fresh water or resort to rivers to spawn. Many of them are of large size, and their flesh is valued as food. Caviare is prepared from the roe, and isinglass from the inner coats of the swim-bladder. Sturgeons feed on worms and shell-fish, which they obtain by routing with their snouts. The type-genus (*Acipenser*) has about twenty species from the rivers of Europe, Asia, and America. The Common Sturgeon (*A. sturio*) often occurs round the British coasts and in the estuaries of our rivers. From six feet to ten feet is about the average length, but larger specimens are recorded. The general colour is greyish above and silvery-white below. In England it has been one of the fishes-royal (q.v.) since the 14th century. Other species are the

Sterlet (*A. ruthenus*), the Hausen (*A. huso*), the Chinese Sturgeon (*A. sinensis*). The genus *Scaphirhynchus*, with four species from Asia and America, has a flat snout.

Sturm, JOHANN (1507-89), reformer and educationist, was born at Sleiden, in the duchy of Luxemburg. Compelled to leave Paris, owing to his religious opinions, in 1536, he retired to Strasburg, and in 1538 became rector of the new gymnasium in that town. Here he was enabled to carry out his educational projects, which were completed in 1564 by the addition of an academy to the gymnasium, the two together comprising a school and a university. He supported Zwingli, and was engaged in constant disputes with the Lutherans of Strasburg.

Stuttgart, capital of the kingdom of Würtemberg, is in the valley of the Nesen, 97 miles S.E. of Frankfort-on-Main. It is surrounded by vineyards, and consists of an Upper Town, with wide streets and squares, and the old part or Lower Town. Among the places of interest are the new and old palaces, two Gothic churches, a library noted for its numerous editions of the Bible, Stadthaus, Parliament House, schools, hospitals, and the Royal Stud, which contains 300 horses. Stuttgart is a great seat of the book trade, and produces all the appliances necessary for it. Other industries are the manufacture of linen, woollen, silk, cotton, gloves, leather, gold embroidery, vinegar, beer; and tin, metals, and castings are largely worked. There are fine alleys, parks, and gardens, and in the neighbourhood are Rosenstein, with the royal summer residence, and Cannstadt, noted for its mineral springs. The town received its name from a castle in 1089, obtained municipal rights in 1119, and in 1320 became the residence of the Counts of Würtemberg.

Style, the tubular portion of the carpel of angiosperms, that in many cases, but not always, intervenes between the stigma, or viscid receptive surface, and the cavity of the ovary. When the style is absent, as in poppies, the stigma becomes sessile on the ovary. When there are several united carpels forming distinct chambers to the ovary, as in lilies, there may be only one style; or there may be as many as the carpels, as in grasses; or there may be one below, dividing above, as in *Iris* and the *Compositæ*. The style generally rises from the apex of the ovary (*terminal*), but sometimes, from the growth of the ovary, it becomes *lateral*, as in the strawberry, or even *basilar*. In *Labiata* and *Boraginaceæ* the united styles of the four-chambered ovary arise laterally and unite from a central depression, and are called *gynobasic*. Though generally rod-like, the style may be *petaloid*, as it is, at least in part, in the *Iridaceæ*. When the styles are of different lengths in different individuals of the same species, it may be of importance in cross-pollination. [HETEROSTYLY.] The tube or canal of the style is generally filled with loosely-arranged cells forming the *conducting-tissue*; but in some cases it is empty. After flowering the style is commonly *deciduous*; but it persists in the fruit stage in strawberries, blackberries, houndstongue, clematis, etc.

Stylites, SIMEON (*circa* 390-460), the first "pillar-saint" (Greek, *stylites*), was born near Antioch. After spending some twelve years in monasteries he withdrew to a lonely Syrian mountain, and there devised the system of penance from which he took his name, living for thirty or forty years on the top of a pillar, the height of which was gradually increased to about 70 feet.

Stylommatophora, one of the two groups of Mollusea forming the Pulmonata (q.v.). It is characterised by the fact that the eyes are situated on the extremities of a pair of tentacles, which may be retracted or expanded at will. The group includes many well-known Mollusea, such as the snails *Helix*, *Pupa*, *Clausilia*; the slugs *Arion*, *Limax*, *Testacella*; etc.

Styptics, substances employed to check the flow of blood from a wound.

Styria, a duchy of Austria, 124 miles long by 112 broad, and containing 8,670 square miles, and having Upper and Lower Austria on the N., Carniola on the S., Hungary and Croatia on the E., and Carinthia and Salzburg on the W. It is chiefly mountainous, belonging to the Noric and Carnian Alps, which send out three chains, reaching in the N.W. a height of 7,700 feet (Grimming) and in the S.W. 8,000 feet (Eisenhut). There are many valleys among the mountains, and in the S.E., in the neighbourhood of the Mur and Drave, the land is level. The rivers Enns, Mur, Drave, and Save belong to the Danube basin. There are many small, beautiful lakes. The lowlands are fertile, and produce good wine, fruit, flax, hemp, and poppy. Extensive forests afford splendid timber for export and fuel for smelting of metals. Among minerals are iron of good quality and in abundance, copper, cobalt, lead, zinc, gold, silver, sulphur, alum, and rock-salt. The manufacture of edged tools is important. Gratz is the capital. The population is mostly German, except in the S., where the Slavonic element predominates.

Styx, a river of Greek and Roman mythology, situated in the infernal regions, across which the dead were ferried by Charon, and by which the gods swore an inviolable oath. It was said to go nine times round hell, and Milton speaks of it as the "flood of burning hate." The real Styx is a rivulet in Areadia, whose waters are said to be pernicious, and its modern Greek name embodies this idea.

Suakim, a Nubian port, on the W. coast of the Red Sea, which has of late come into importance as being the base of British military operations in the Sudanese War. Part of the town is on the mainland, but the greater part is on a small island. It has a shallow harbour and is well fortified. The chief buildings are the mosques, the residence of the Governor, custom-house, and bazaar. There is a trade in gums, hides, butter, cattle, ivory, ostrich feathers. The town is still held by a British force.

Suarez, FRANCISCO (1548-1617), a learned Jesuit, born at Granada. In 1597 he became professor of theology at Coimbra. As a schoolman he attempted to reconcile the views of Realists and

Nominalists regarding Universals. In theology his *Congruism* was a development of the views of Molina (q.v.). His *Tractatus de Legibus ac Deo Legislatore* claims a divine origin for all laws, but combats the divine right of kings. The *Defensio Catholica Fidei* was written in opposition to the claims of sovereignty put forward by James I. of England.

Sublimation. Many solids can be distilled in the same way as liquids; the application of heat transforms them into vapour. When the vapour comes into contact with a cold surface, a deposit of the solid occurs, which is known as a sublimate, and the process of direct conversion of vapour to solid is known as sublimation. Many substances are purified in this way—*e.g.* arsenious acid, sulphur, corrosive sublimate, etc.

Subpœna, a writ issuing out of a Court having jurisdiction therefor, by which persons are commanded to appear at a certain place to give evidence under a heavy penalty for disobedience. It is the means by which evidence is brought for consideration in a pending action or other proceeding.

Substance, in theology, the Divine Being, or Essence, common to the Three Persons of the Trinity.

Succession, WAR OF. [SPAIN.]

Succinic Acid is a compound which possesses the formula $C_4H_6O_4$, and may be chemically named ethylene dicarboxylic acid. It occurs naturally in a number of sources, as in amber and other resins, in various plants, and, in small quantities, in animal organisms. It is also a product of various kinds of fermentation—*e.g.* in small quantities in the ordinary alcoholic fermentation of sugars. Synthetically it may be obtained by very many reactions which, together with its chemical properties, prove its constitution to be that represented by $(CH_2 \cdot CO_2H)_2$. It is soluble in water, almost insoluble in alcohol, and easily soluble in ether. It forms crystals belonging to the monoclinic system, which melt at 180° , but decompose if heated much higher. If added to solutions of ferric salts, it causes a precipitate of ferric succinate, and this reaction is made use of in the separation of iron from manganese salts. It forms a large number of important organic derivatives, amongst these being the compound *asparagine*, which occurs in asparagus, beans, peas, beetroot, and other plants. An acid known as *iso-succinic acid* possesses the same composition as succinic acid, the difference being due to a difference of constitution. It may be distinguished by its more ready solubility in water and lower melting-point (130°).

Suchet, LOUIS GABRIEL, DUC D'ALBUFÉIRA (1770-1826), Marshal of France, was born at Lyons. After distinguishing himself in Italy (1796-97), in Egypt (1798), in Italy again (1798-1801), and in the campaigns against Austria (1805) and Prussia (1806), he was given the chief command in Aragon (1809), and within two years brought the province completely under his control. He became Marshal of France in 1811, and, after subduing Valencia in 1812, received the title of Duc d'Albuféira. He rejoined Napoleon during the Hundred Days.

Sucking-Fish, a name for the Remora (q.v.). Used also of other fishes in which the fins are modified to form a suctional disk.

Suckling, SIR JOHN (1609-42), poet and courtier, was born at Whitton in Middlesex, and studied at Cambridge. After travelling on the Continent and serving ten months under Gustavus Adolphus (1631-32), he earned a great reputation at Court as a poet, wit, and leader of fashion. During the Civil War he raised a troop of horse to serve against the Covenanters, but was driven back with the other royal forces at Duns. In consequence of a plot to release Strafford with French aid, he withdrew to Paris, and is said to have there committed suicide. His dramas have no great merit, but he wrote many exquisite lyrics.

Suction Pump. [PUMP.]

Sudamina (*Miliaria*), a skin eruption met with in association with profuse perspiration.

Sudarium, a handkerchief, specifically that attached to a pastoral staff.

Sudorifics, another name for diaphoretics (q.v.).

Sudras, the fourth caste of the Hindu social system; but the word has an ethnical value, because the Sudras were the Mongoloid aborigines, who after the Aryan conquest of North India preserved their personal freedom by adopting the Brahminical religion, language, and general culture; are everywhere now intermingled, especially with the Vaisyas or third Aryan caste.

Sue, MARIE JOSEPH EUGÈNE (1801-57), a French novelist, born at Paris. He at first followed his father's profession of army surgeon, but quitted it on inheriting his fortune in 1829. His best-known books were *Les Mystères de Paris* (1842) and *Le Juif Errant* (1845).

Suet, the comparatively firm fat in the loins of oxen, sheep, and other quadrupeds.

Suetonius (CAIUS SUETONIUS TRANQUILLUS), b. circa 70 A.D., Roman historian, grammarian, and critic, was the son of a military tribune, and started in life as an advocate at Rome. He was on intimate terms with the younger Pliny, whose letters to him are extant. Hadrian made him his private secretary (*magister epistolarum*), but he lost the appointment owing to his want of respect to the Empress Sabina. His only important work is the *Vitæ Duodecim Cæsarum* (*Lives of the Twelve Cæsars*), which are valuable for their anecdotes illustrating the characters of the Emperors.

Suez, an Egyptian town to the extreme N. of the Red Sea, and at the S. entrance of the Suez Canal (q.v.). It is 76 miles E. of Cairo, with which town, as well as with Alexandria, it is connected by railway; and a railway crossing a shallow arm of the Red Sea connects it with Port Ibrahim. Among the chief buildings are the Viceroy's villa, the Greek church, the hospital, the custom-house, and the Government salt factory. The construction of the Suez Canal and of the Freshwater Canal has brought European trade and improved prospects to Suez.

Suffocation. [ASPHYXIA.]

Suffolk, a maritime county of England, having the German Ocean on the E., Norfolk on the N., Essex on the S., and Cambridge on the W. It is 56 miles long by 32 broad, with a coast-line of 50 miles and an area of 1,500 square miles. Of its rivers, the Stour bounds it on the S., and flows past Sudbury, Nayland, and Harwich to the German Ocean; while the Waveney and the Little Ouse form the north boundary. The Lark flows into the Great Ouse, while the Gipping unites with the Orwell, and, flowing past Ipswich, falls into the Harwich estuary. Other streams are the Deben, Alde, and Blythe, but not many of these rivers are navigable. The county is well served by the Great Eastern Railway. The surface is for the most part level, and the soil consists of clay, sand, loam, and fen. The interior from N. to S. is very fertile, and produces quantities of butter. In the E. and W. the sandy soil is fertile, with an admixture of loam, while the barren heath lands of the N.W. abound in sheep-walks and rabbit-warrens. The loam along the river valleys is extremely fertile, and brings forth barley—much prized by brewers—wheat, peas, and beans. The breed of sturdy cart-horses known as "Suffolk Punches," and a small variety of black pig, are peculiar to the county. The sea encroaches on the eastern coast, and Dunwich and Aldeburgh were once important towns, now to a great extent washed away. There is a trade in corn and malt from the ports; sea-salt is manufactured on the coast; herring and mackerel fishing employ many; Aldeburgh is noted for sprats; and the Orwell has oyster beds. There are five Parliamentary divisions, each returning one member; Ipswich returns two, and Bury St. Edmunds one.

Suffren Saint-Tropès, PIERRE ANDRÉ DE (1729-88), a distinguished French naval officer. After nearly 40 years' service against the English he was, in 1781, placed at the head of a squadron designed to act against them in the East Indies. He engaged in several well-contested but indecisive battles, and captured Trincomalee. In 1784 he returned to Paris. He was Bailli of the Knights Hospitallers.

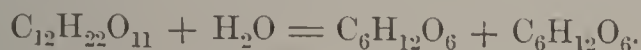
Sufism, the philosophy of the *Sūfīs*, Moham-medan mystics (dervishes and fakirs) who hold that all existing things are emanations from the deity, by whom all human actions are directed, so that there is no real distinction between good and evil. They hold that the body is the prison of the soul, and that death is an object of desire, since at death the soul returns to the deity. The system is based on an allegorical interpretation of the poems of Hafiz.

Sugar is formed in plant-cells as one of the earliest products of assimilation. It may possibly originate in the polymerisation of formic aldehyde, according to the equation:—



According to the recent researches of Messrs. Brown and Morris, the first sugar to be thus synthesised belongs to the saccharon or cane-sugar

($C_{12}H_{22}O_{11}$) group. This acts apparently as a temporary reserve-material in the leaf until it passes a certain degree of concentration, when the more stable starch is formed, the first visible product. The cane-sugar passes into dextrose and levulose:—



Of these two, dextrose is apparently more quickly used up for respiration, and perhaps also for tissue-forming, so that most of the sugar that passes out of the leaf is levulose. The starch is translocated as maltose ($C_{12}H_{22}O_{11}$). Cane-sugar also occurs undoubtedly as a reserve-material in stems and roots, so that Sachs' summary of observations on the beet, "starch in the leaf, glucose in the petiole, cane-sugar in the root," might perhaps be modified into "cane-sugar, with starch as surplus, in the leaf, levulose in the petiole, and cane-sugar and starch in the axis."

Sugar-Cane (*Saccharum officinarum*), an arborescent grass, probably a native of India, cultivated from time immemorial in China, and probably introduced into Sicily, Crete, Rhodes, and Cyprus by the Saracens, into Spain by the Moors, and into the Canaries, Madeira, Brazil, and the West Indies by the Spaniards and Portuguese. It is now generally grown within 40° on either side of the equator. It has a solid stem of numerous short internodes; flowers in a loose panicle, enveloped in long, woolly hairs and with woolly, violet stigmas.

Sugars. Although originally the term "sugar" was given to all substances which were characterised by a sweet taste, it is now confined to a number of carbohydrates (q.v.) which are all closely related in both their chemical and physical properties. They are all obtained as products of animal and vegetable life, and until recent years all attempts to prepare them synthetically had proved abortive. The earliest known was ordinary cane-sugar; afterwards the sweet products derived from beet, maple, sorghum, etc., were recognised as similar; while one by one milk-sugar, grape-sugar, and other varieties were added to the list of these compounds. Chemically they may be divided into two classes—the *sucroses*, resembling cane-sugar and possessing the formula $C_{12}H_{22}O_{11}$; and the *glucoses*, of which grape-sugar is a type, to which corresponds the formula $C_6H_{12}O_6$. They are neutral substances, soluble in water, and usually capable of being obtained crystalline. Professor E. Fischer, by whom their artificial syntheses have been effected, has shown that in their chemical nature they are compounds belonging to the class of either *ketones* (q.v.) or *aldehydes*—i.e. possessing the general formula $X \cdot CO \cdot X$ or $X \cdot CHO$, where X is a hydrocarbon radical. Almost all possess the power of acting on polarised light, most of them existing in three varieties, which are respectively dextrorotatory, lævorotatory, and inactive. Of the sucrose, *cane-sugar* is the best known. There seems evidence that the cultivation of the sugar-cane was first carried on in Eastern Asia, and crude sugar was obtained from the same source in the 7th century by the Chinese. The cultivation spread westward, and during the Middle Ages Venice was one of its

most important seats, while it was further spread west by the agency of the Spanish traders. The sugar-cane (*Saccharum officinarum*), of which many varieties exist, is a great species of grass, the stalks of which reach usually a height of about 12 feet. When ripe, the canes are cut down close to the ground, the leaves and shoots taken off, and the canes immediately crushed by steel rollers. The juices from the *crushers* are collected in a trough, where they form a yellowish-green, turbid liquid. This is filtered through sieves, and treated with milk of lime in large iron vessels or *clarifiers*, until a thick scum is formed upon the surface. The underlying clear liquid is drawn off and concentrated in copper pans until sufficiently strong, when it is set aside to crystallise, the portion which still remains liquid being known as *molasses*. The raw product still requires refining. For this purpose the crude sugar is dissolved in water in large iron tanks, kept well stirred, and heated by steam, after which it is strained through cotton bags, and is decolorised by passing through many layers of animal charcoal. It is then concentrated under reduced pressure in large vessels (*vacuum pans*), and poured into moulds to crystallise completely, the crystals being finally dried in centrifugal machines. Methods essentially similar in most respects are employed for the production of sugar from beet and maple. Pure cane-sugar is a white crystalline compound, which forms crystals of the monoclinic system. It melts at $160^\circ C.$, but decomposes if heated further. Under the influence of dilute acids and of certain ferments it splits up into glucose and levulose, the process being known as *inversion*. This mixture may then, by the further action of the ferment, undergo some of the numerous forms of *fermentation* (q.v.), as that resulting in the formation of alcohol. *Milk-sugar* or *lactose* (q.v.), which crystallises in rhombic prisms, and maltose, which results from the action of *diastase* on starch, as in brewing, both possess the same composition as cane-sugar, and resemble it in most of their chemical properties. Of the *glucoses*, the best-known are *grape-sugar*, also known as *dextrose* or *glucose*, and *fruit sugar*, also known as *fructose* or *levulose*. Other varieties of this class are *mannose*, a derivative of mannite, which occurs in various plant seeds; *galactose*, obtained from lactose by the action of acids; and *sorbinose*, which occurs largely in mountain ash berries. [CARBOHYDRATE, FERMENTATION.]

Suidæ. [FIG.]

Suidas, the author of a Greek lexicon, is supposed to have lived at Constantinople in the 10th or 11th century. Besides explanation of words, it contains articles on matters of historical and geographical interest, with valuable quotations from lost writings.

Sulla, LUCIUS CORNELIUS (138–78 B.C.), Roman general and statesman, belonged to an ancient patrician family. As quæstor under Marius in Africa (107–6), he persuaded Bocchus to surrender Jugurtha, and thus brought the war to a close. He served a second time under Marius against the

Cimbri and Teutones (104-1), but even at this early date the jealousy of the popular leader had made Sulla his enemy. In 92 he went to Cilicia as pro-prætor, and succeeded in reinstating Ariobarzanes on the throne of Cappadocia. After his return he was generally accepted by the aristocratic party as their leader. In the Social War his success was more conspicuous than that of Marius, his greatest triumph being the capture of the Sannite capital, Bovianum. After holding the consulate in 88, he received from the Senate the command against Mithradates, but the tribune Sulpicius stirred up a tumult, and Sulla escaped with difficulty to Nola in Campania. He soon returned at the head of his legion, however, and Marius was forced to seek refuge in Africa. Early in 87 he crossed over to Greece, captured and sacked Athens (86), defeated Archelaus, the general of Mithradates, at Chæronea (86) and Orchomenos (84), and, advancing across the Hellespont into Asia, negotiated a peace which brought the war to a close. Fimbria, the Marian general in Asia, was easily defeated, and in 83 Sulla again set foot on Italian soil. The Marian cause had triumphed during his absence, but as he advanced his opponent's army melted away, and a victory at Præneste in 82 threw open the way to Rome. The army raised by the Samnites was vanquished, and a general proscription of Marians was followed by a fearful massacre. Sulla, who had assumed the surname of Felix, now ruled as dictator, and carried out a series of measures by which the aristocratic form of government was completely re-established. In 79 he resigned the consulship, and retired to Puteoli, where he gave free reins to his appetite for every form of sensual indulgence.

Sullivan, SIR ARTHUR SEYMOUR (b. 1842), was born in London, and studied at the Royal Academy of Music and the Leipzig Conservatorium. His most popular compositions are the inimitable comic operas produced in conjunction with Mr. W. S. Gilbert. Among works of a higher class are the opera of *Ivanhoe* (1891), *The Golden Legend*, a cantata (1886), and the *Te Deum* for the Prince of Wales's recovery (1872).

Sully, MAXIMILIEN DE BÉTHUNE, DUC DE (1560-1641), French statesman, was born at the château of Rosny, near Mantes. Prior to 1606, when he received the dukedom, he was known as the Baron de Rosny, a title he inherited from his father. He did good service to the Huguenot cause, distinguishing himself greatly at the battle of Ivry (1590), and, after the accession of Henri of Navarre, became his most trusted minister. By his skill as a financier he averted the bankruptcy which seemed to be overtaking the kingdom. Soon after his master's death he retired from Court, and occupied his leisure in composing his egotistic but interesting *Mémoires*.

Sully-Prudhomme (RENÉ FRANÇOIS ARMAND PRUDHOMME) (b. 1839), has published *Stances et Poèmes* (1865), *Les Épreuves* (1866), *Les Solitudes* (1869), and other works, which give him a high rank among French poets. His most ambitious efforts are *La Justice* (1878) and *Le Bonheur* (1888).

Sulphates. [SULPHURIC ACID.]

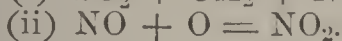
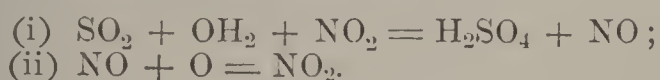
Sulphides (formerly called sulphurets) are compounds consisting of sulphur united with some other element or radical, and may hence be regarded as derived from the compound SH_2 (sulphuretted hydrogen) by the replacement of the H by other elements. The compounds of *sulphur* with non-metallic elements—*e.g.* with chlorine, bromine, etc.—although very interesting chemically, are not of great commercial or technical importance. The metallic sulphides, however, are of great importance; many of them exist as natural deposits, and form very important ores of the metals. Examples of these are—*galena*, sulphide of lead; *blende*, sulphide of zinc; *copper pyrites*, sulphides of copper and lead; *cinnabar*, sulphide of mercury; *realgar*, sulphide of arsenic; and many others. The metallic sulphides are usually hard solids insoluble in water, the sulphides of the alkalis and alkaline earths being, however, soluble. Besides their use as ores, many sulphides find other applications. Thus, *pyrites* are largely used as a source of sulphur or in the preparation of sulphuric acid; *cinnabar* is extensively used as a pigment. Most of the sulphides may be prepared artificially as white or coloured precipitates by passing sulphuretted hydrogen into acid or alkaline solutions of metallic salts. Organic sulphides are also well known, the whole class of compounds known as *mercaptans* being completely analogous to the metallic sulphides, while *carbon disulphide* (CS_2) is a most important and technically useful liquid.

Sulphonal is a compound represented chemically by the formula $\text{C}_7\text{H}_{16}\text{S}_2\text{O}_4$, which may be obtained by rather complicated chemical processes. It is a colourless substance which crystallises in bright flakes which melt about 125° . It is said to produce refreshing sleep without interfering with digestion; its action is, however, somewhat uncertain, and it sometimes produces giddiness and skin eruptions.

Sulphur occurs native most frequently in volcanic regions; or in thick beds associated with gypsum and celestine, as in Sicily; or as a deposition from geysers; or as a sublimate in volcanic craters, as at Kilauea. It crystallises in the Prismatic system in sulphur-yellow, translucent crystals, with resinous lustre, a hardness of 1.5 to 2.5, and a specific gravity of 2. Though much sulphur in commerce is obtained by roasting pyrites, native sulphur is the source of a considerable proportion of that which we use. In medicine sulphur has been largely employed in the form of unguentum sulphuris in the treatment of certain skin diseases, and particularly with a view to destroying the parasite of Scabies (itch). The confection of sulphur of the Pharmacopœia is a mild laxative, and is often given to promote the action of the skin and to regulate the bowels in persons who suffer from chronic skin disease. Sulphur has also been largely used in the treatment of chronic rheumatism.

Sulphuric Acid. Of all the acids which find employment in the various industries of the country

this compound is by far the most important, being, directly or indirectly, useful in almost every industrial process. It appears to have been known in the alchemistic period, and was then prepared by heating copperas. Its manufacture by heating sulphur and nitre was carried on in the 17th century. The first sulphuric acid works were established at Battersea in 1772, and the erection of other similar works was soon followed by various improvements in the methods of its production. The present method of carrying out the process is as follows:—By heating pyrites in suitable kilns or furnaces sulphur dioxide is formed, which passes with the excess of air into a large lead chamber, into which pass also jets of steam and nitric acid fumes produced by the action of sulphuric acid upon Chili saltpetre. Here by the interaction of these compounds sulphuric acid is formed, and collects at the bottom of the chamber. The nitric fumes get reduced to lower oxides, but are again oxidised by the air present also. The remaining gases pass into a second chamber and again meet steam jets, more acid being deposited, and are then drawn into a third chamber, where a similar effect is produced. What then remains of the gases, now almost solely nitric fumes, and air are drawn up a chimney—the “Gay Lussac tower”—in which they meet a descending spray of strong sulphuric acid, which absorbs the nitric fumes, this nitrated acid afterwards giving up the fumes to the sulphur dioxide in the “Glover’s tower” before the gas enters the lead chambers. The sulphuric acid is drawn off from the chambers, and then contains about 64 per cent. pure acid. It is concentrated first in leaden pans, and finally in glass or platinum vessels. The manufacturing process depends on the power of nitric oxides to oxidise sulphur dioxide and of the nitrous oxides to absorb oxygen, and so make the process continuous. The following equations represent these reactions:—



The pure acid has the composition H_2SO_4 , and is a thick, colourless, oily liquid, known also as *oil of vitriol*. If mixed with water, much heat is evolved, the mixture being attended by a contraction in volume. Owing to the readiness with which it absorbs water, it forms an admirable desiccator for gases, etc. It is a powerful acid forming a series of salts known as *sulphates*. If both hydrogen atoms are replaced by metals, *normal* sulphates result, *acid* sulphates being salts in which only one hydrogen is so replaced. The uses of the acid, both in pure chemistry and in technical and industrial processes, are too manifold for enumeration, whilst many of its salts also are important commercially. Thus ferrous sulphate, or *copperas*, is largely employed in chemistry, in dyeing, and in the manufacture of inks; copper sulphate or *blue vitriol* is used in electroplating, as an insecticide for phylloxera, in dyeing, etc.; calcium sulphate is well known under the name of gypsum, zinc sulphate as white vitriol, while the sulphates of sodium, potassium, and ammonium are important compounds. The numerous compounds known as alums are also

all double sulphates—i.e. the sulphuric acid radical united with two different metals.

Sumach, the general name for various species of the genus *Rhus* belonging to the Terebinthaceæ, a genus which includes also the Japan lacquer-tree. Most of the species are shrubs with pinnate leaves, small, generally unisexual flowers, and small drupaceous fruits. *R. venenata*, the poison-elder, and *R. Toxicodendron* are poisonous American species. *R. Coriaria*, a native of the Mediterranean area, is the tanning sumach, the leaves of which form the commercial *sumach*, used in tanning and dyeing; and *R. Cotinus*, of the same district, is the Venetian Sumach or Wig-tree of our gardens, the branches of which are the yellow dye-wood known as young fustic. It gets its name of wig-tree from the remarkable red-branched plume formed of barren pedicels. We import about 12,000 tons of sumach annually, valued at £135,000, nearly all from Italy.

Sumatra, an island of the Indian Ocean, upon the Equator, separated from the Malay Peninsula by the Straits of Malacca, and extending in a N.W. and S.E. direction. It is the next largest to Borneo of the Asiatic isles, and is 1,000 miles long by 240 broad, containing 140,000 square miles. The E. side is level, but the W. mountainous, there being two or three ridges almost parallel to the coast. The average height of these is in the S. from 2,000 to 3,000 feet, while in the N. they rise to 5,000 feet, receding from the shore still farther N., and declining into hills. The highest peak is Indrapura (12,000). There are some volcanoes in the island. Of the rivers, those on the W. are short mountain torrents, but those on the E. are long, and end in deltas. The chief of these are the Rawas, Jambi, and Indragiri. There are several lakes, the largest being Sankara, 12 miles by 4, and Dano, somewhat smaller. The temperature of the island is equable, but the S. is visited by heavy and almost continual rain. The geological formation of the island is trachyte, syenite, granite, porphyry, red sandstone, limestone, and some basalt; excellent coal is found, and iron, tin, copper are abundant. Vegetable life is varied and abundant. The forests are so dense that it is said an ape might traverse the island from N. to S. without touching ground. Among the trees are mangroves on the coast, palms, oaks—at a height of from 900 to 6,000 feet above sea-level—the upas-tree, camphor-tree, Rafflesia, etc. A Dutch expedition in 1877 is said to have collected 400 varieties of useful timber. There are all kinds of gaudy flowers, all tropical fruits, especially the mangosteen and durian. Animal life is equally luxuriant: 120 species of mammals, 270 species of birds, and 40 different kinds of snake, including the python and boa, have been observed, and there are many varieties of beetles and butterflies. Among the larger animals are the rhinoceros, elephant, tiger, and ourang-outang. The domestic animals are chiefly the pig, cow, a small breed of horse, and the buffalo. The Dutch possess much of the island, and exercise a kind of protectorate generally. They make six divisions of their possessions—(1) West Coast (46,200 square miles), capital Padang; (2) Bencoolen (9,576), capital Bencoolen; (3) Lampong

in the S. (9,975); (4) Palambang on the E. coast, capital Palambang (61,900); (5) East Coast farther N. (16,282); and Acheen, in the extreme N., only partially subdued. The population of the island is very mixed. There are Malays, Chinese, Arabs, Hindus, Orang Kubu, who are savages, and the Menangkabu, who are pure Malay. But the most curious native race are the Battah. They are short and sturdy, and closely resemble the Caucasian type. They have known writing from time immemorial, but they have the peculiarity of starting from the left and writing vertically upwards in successive lines. Their one vice appears to be cannibalism. The natives live in independent village communities, and have neither temple nor priest.

Sumner, CHARLES (1811-74), an American statesman, born at Boston, studied at Harvard, and was called to the bar in 1834. After a three years' visit to Europe he settled in Boston, and in 1845 produced a deep impression by his speech against war entitled *The True Grandeur of Nations*. He helped to found the Free Soil Party (1848), and in 1851 was elected to the Senate, where his powerful speeches on the anti-slavery side excited so much animosity that he was brutally attacked by Preston Brooks, a Senator for South Carolina, receiving injuries which disabled him for three years. He was re-elected in 1859, and in 1860 delivered his speech, *The Barbarism of Slavery*, occasioned by the claim of Kansas to be admitted as a free state. From 1861 to 1871 he was chairman of the committee on foreign affairs in the Senate.

Sumter, FORT, so called after a Revolutionary general, is situated on a shoal in Charleston Harbour, $3\frac{1}{2}$ miles from the town of Charleston. When, in 1860, South Carolina seceded from the Union, Major Anderson, the commandant, made a determined stand in this fort, with 80 men and 62 guns. General Beauregard attacked him (April 12-14, 1861) without success, and this was the beginning of the war. The fort was attacked from the sea by monitors in April, 1863, but held its own, but in July a bombardment from Morris Island silenced it in a week. The garrison still held on, and defeated a sea attack in September. In the autumn it was bombarded for 40 days, and again in the following summer, but it was not till April, 1865, that the Federals gained possession of it, and then only by the capitulation of the town.

Sun is the centre of the system of bodies consisting of the planets and their attendant satellites. To them he radiates light and heat; he regulates their movements, and controls their distances from himself. But he was not always regarded as the centre of this system. It was true that his apparent motions were the cause of day and night, and gave the variations in the seasons, but these apparent motions were regarded in early times as actual. It was natural that so obviously important a body should receive attention, and so we find that the Egyptians as well as the Chaldees recorded their observations on his movements and eclipses. After Copernicus had asserted that the Sun, and not the

Earth, was the centre of our system, and that the Earth and other planets moved round him, it began to enter into men's minds to consider him in different ways and to attempt to discover the cause of his power and the mysteries of his constitution. One of the most obvious problems to solve was to find his distance from the Earth, and this could only be done by making use of measurements concerned with other planets besides the Earth. This problem of finding the Sun's distance is of immense importance, but, owing to its extreme difficulty, it is not quite settled even now. This distance—the radius of the Earth's orbit—is the unit of length of the universe; distances of the stars are measured in



THE SUN.

terms of it, and any error in its computation will give rise to multiplied errors throughout the whole range of astronomy. The problem, stated in its simplest form, is to find what angle is subtended at the Sun by the Earth's semi-diameter; and, if it were not for the presence of our own atmosphere, this could be found out by direct measurements on the Sun when he is on the horizon, but the disturbing effects of the atmosphere make such a solution impossible. Indirect means had, therefore, to be devised for obtaining the value of this angle or horizontal parallax. [PARALLAX.] Aristarchus had attempted to compare the distances of the Earth from both Sun and Moon, but his method was naturally imperfect. Relative distances of the different planets from the Sun have, however, been known since the time of Kepler [KEPLER'S LAWS], so that only one absolute measurement was necessary in order to know all the others, provided that that measurement could be relied upon. In 1672 Richer at Cayenne and Cassini at Paris, from observations on the opposition of Mars, estimated the Sun's distance to be about 87,000,000 miles. Flamsteed gave it as 81,700,000 miles, and Picard as 41,000,000. The differences were truly enormous. The transits

of Venus were now hailed as a means of solving the problem. At the rare times when Venus partially eclipses the Sun, the planet appears as a dark spot on the Sun's disc, and it is only necessary to exactly determine, on the one hand, the moment when she enters the brightness or leaves it, or, on the other, the time she takes to complete the passage. Unfortunately for this, these transits are rare; two



PROMINENCES ON THE SUN.

take place within about eight years, and then there is a gap of over a century. The transits observed in 1761 and 1769 were found to give the most discordant results, until Encke, in 1824, published the result of his interpretations of the different observations. He gave 95,250,000 miles as the probable value, and this was gladly accepted till doubts were published by Hansen in 1854 and re-echoed by other observers. An opposition of Mars in 1862 reduced the value to about 91,000,000, and supported the views of the doubters. Again Fizeau and Foucault had succeeded in measuring the velocity of light by means of measurements on the Earth only, and in the same year (1862), by using this velocity, Foucault, too, came to the conclusion that the Sun was nearer than Encke had deduced. Astronomers looked forward to the coming transit of Venus of 1876 with confidence, believing that this would settle all doubt. Halley's method, published in 1706, was improved, and the difficulties of Delisle's (of 1760) were found to be greatly decreased owing to modern methods of fixing longitudes; to these two methods photography was added, and the world was breathless with expectation as the time of transit drew near. Then it was found that from the eighty different improvised observatories conflicting statements poured in. A new difficulty arose: the atmosphere of Venus introduced the effects of refraction, and the bewildered observer was unable to say when the transit actually began or ended. The transit of 1882 left the uncertainty still nearly 2,000,000 miles. In 1877 Dr. Gill obtained a good result from an opposition of Mars, and later (in 1888) observed the minor planet Iris, following this work with similar observations on Victoria in 1889. From his work the value

92,700,000 miles is accepted as having the smallest probable error, an error regarded as less than 200,000 miles.

If evidence on the Sun's distance shows great laxity in agreement, much more disagreement has prevailed as to the estimate of the Sun's temperature. Newton first investigated the amount of heat received by the Earth, and many have followed his lead. Pouillet discovered that the vertical rays of the Sun bestow upon every square centimetre 1.7 gram degree Centigrade units of heat per minute. Then laws were suggested, connecting this measurable quantity with the temperature of the Sun, allowance being made for absorption of heat by the atmosphere. But laws which answered for moderate temperatures were shown to fail at high ones, and measurements of a different kind were introduced. It was found that the Sun's own atmosphere absorbed a considerable amount of his radiation, and Frost in 1891 showed that this absorption was about seven-seventeenths of the whole. Langley in 1880 began to measure the intensity of different rays in the spectrum by means of their effect on the electrical conductivity of platinum, and after untiring research he was led to raise Pouillet's constant from 1.7 to 3 gram degrees as the value of the Sun's heat unaffected by our atmosphere. Of this, however, hardly 60 per cent. reaches the Earth's surface. Deductions as to the actual temperature of the Sun are not reliable, as we do not know how matter behaves in the unknown condition in which it exists in the Sun. Viöle in 1876 suggested 1,500° to 2,500° C. as the possible limits, but in 1881 raised the



SOLAR CORONA, MAY, 1882.

value to 3,000° C., while in 1892 Le Chatelier gave it as 7,600°. The subject is still, therefore, shrouded in uncertainty.

Observations during eclipses, enormously helped since 1860 by the use of photography, have taught us much about the Sun's surface. The spectroscope has in the hands of many observers disclosed the presence of iron, nickel, magnesium, sodium, and,

in fact, nearly all the known metals in the form of vapour upon the solar surface. Above these rise the vast jets of *flame* or prominences, which are again succeeded by the *corona*. Beneath the metallic vapours comes the photosphere, the limit of the solar disc. Beginning at the outside, the *corona* may be said to be a solar appendage, but not a solar atmosphere. It has been seen to reach a distance from the Sun equal to twelve times his own diameter. It does not seem to be affected by gravitation to the Sun. There is no increase of density nearer the luminary; neither does it rotate with the Sun. It consists of gaseous matter, among which is hydrogen and an unknown substance called "coronium," while particles in the solid or liquid state are also present. It is continually in a state of motion to and from the Sun, but the constituent atoms must be so far apart as to represent what we should regard as a high vacuum. Comets pass through it with unaffected velocity. The average appearance of the *photosphere* is that of a heap of sand or shot spotted over with points of blackness, but spread over this are bands and spots of less granular appearance. The more granular part has been described as the "willow-leaf" structure, and is probably due to the difference in brightness of rapidly ascending and descending currents of vapour. The uniformity of the photosphere is also interrupted, especially in certain belts, by what are known as *sun spots* (q.v.). Near these are often to be seen white raised tracts called *faculae*, regions giving evidence of great pressure.

The *chromosphere* is a vaporous layer completely enveloping the photosphere, and consisting of hydrogen and an unknown element, "helium." It is several thousand miles thick, but varies from time to time. It has been an object of much beauty and interest during eclipses, when it is seen to be of a reddish tint with an irregular edge. While the true atmosphere constantly sends flashes of vapour (containing iron, magnesium, etc.) into it from below, it, on the other hand, shoots up into enormous *prominences* like clouds and flames, of which the cloud-like ones are more permanent. Although these protuberances were first noted only during eclipses, since 1869 they have been observed constantly by means of a special arrangement of the slit of the spectroscope suggested simultaneously by Lockyer and Janssen. The *corona*, however, has as yet only been studied during eclipses, and its constitution is unsettled, although the existence of rapidly-dispersing clouds of hydrogen above the prominences has led to the belief that the corona, too, may consist of the same gas, highly-rarefied and accompanied by more helium, the illumination being caused by magnetism. The combined spectroscopic and photographic appliances have done good work in this branch of astronomy, and Professor Hale has succeeded in photographing *faculae*, spots, prominences, chromosphere—in fact, all the phenomena of the solar surface.

Sun-Bear (*Ursus malayanus*), from the islands of the Malay Archipelago. The length is somewhat less than 5 feet, and the fur smooth and black. The tongue is extensile.

Sunbird, any bird of the Passerine family Nectariniidæ, with several genera, chiefly from Africa, the south of Asia, and Australia. They are small birds, of very brilliant plumage, feeding chiefly on insects, but also on fruit and on the nectar of flowers, sipping the latter with their long bills.

Sunda Isles, the general name of a group in the Indian Archipelago, divided into Greater and Lesser. The Greater contain Borneo, Sumatra, Java, Celebes, Madura, Banks, and Billiton; and the Lesser contain nine smaller islands, together with the Timor islands.

Sunday-Schools, founded by Mr. Raikes, of Gloucester, in 1781, for instructing and influencing children and young people on Sunday. At first the teachers were paid, but now most of the teaching is gratuitous, the change having become general at the beginning of this century. The teaching is becoming exclusively religious (as has always been the case in the Scotch Sabbath-schools) with the spread of secular education. In America Sunday-schools were instituted in 1816, and rapidly spread.

Sunderland, parliamentary (two members) and municipal borough of Durham, is at the mouth of the Wear, being 13 miles N.E. of Durham and 12 S.E. of Newcastle. Upon the S. bank of the river are Sunderland proper, with Bishopwearmouth to the W., and on the N. bank is Monkswearmouth. The old parish church of St. Peter is in Monkswearmouth, and occupies the site of the monastery where lived the Venerable Bede. The N.E. Railway has a line here, crossing the river by a high-level bridge, and reaching the Central Station by means of a cutting and a tunnel. Among the buildings are a fine Town Hall, Museum, Art Gallery, Free Library, and many other halls, etc. The parks cover forty-four acres. Besides the railway bridge, there is a cast-iron bridge over the river. Two piers with lighthouses form the entrance of the harbour, and a harbour of refuge is being constructed. The docks and basin occupy 78 acres, the principal one being on the S., and having openings to both river and sea. The export of coal is very great, and over two millions of tonnage pass out and in annually. Shipbuilding gives cause for extensive manufacturing of ship requisites, and other industries are the making of glass bottles, sheet- and plate-glass, and earthenware. Much lime is burnt, and there is a large fish trade.

Sunderland, ROBERT SPENCER, 2ND EARL OF (1641–1702), a consummate political intriguer, unmatched even in his own day for duplicity and restless ambition. Although he had supported the Exclusion Bill, he attached himself to James II. on his accession and became his first Minister, conforming outwardly to the Roman Catholic religion and sharing the king's most secret counsels. Yet at this very time he was in correspondence with William of Orange, and, although he was not included in the Act of Indemnity, he was able to present his conduct in such a favourable light that he gained the king's complete confidence and eventually became Lord Chamberlain (1697). His son, CHARLES SPENCER, 3rd Earl (1675–1722),

strengthened his position among the Whigs by a marriage with Marlborough's daughter, and was Secretary of State from 1706 to 1710. His intrigues against Townshend and Walpole were crowned with success in 1717, when he again became Secretary of State. In 1718 he was made First Lord of the Treasury and Prime Minister, and Walpole and Townshend, finding opposition useless, entered into a coalition with him. The South Sea Bubble (q.v.) brought about his fall, and at the time of his death he is said to have been in correspondence with the Pretender.

Sundew, the popular name for the species of the large genus *Drosera*, the typical genus of the order Droseraceæ. There are three British species. They have small fibrous roots; rosettes of reddish radical leaves covered with "tentacles," or lobes ending in glands, each of which secretes a glistening dewlike drop of liquid; and a scorpioid, or apparently circinate, inflorescence of minute white flowers, which are generally cleistogamous. The sundews are all carnivorous plants (q.v.), *D. rotundifolia* having been more thoroughly investigated than any other of these plants. All three British species grow in bogs and moist heaths.

Sundial. [DIAL.]

Sunfish, any fish of the genus *Orthogoriscus*, of the Globe-fish family, with two species widely distributed in tropical and temperate seas. The body is compressed and very short, but cannot be inflated with air. The Short Sunfish (*O. mola*) attains a length of 7 or 8 feet, and is often taken on our southern coast and on the coast of Ireland, as it basks on the surface. The Oblong Sunfish (*O. truncatus*) occurs less frequently.

Sunflower (*Helianthus annuus*), a magnificent Composite, said to be a native of Mexico and Peru, and introduced, like its congener the Jerusalem artichoke, about the end of the 16th century. It has large coarse leaves and flower-heads a foot or more in diameter, which are great favourites with bees. It does not ripen its fruits so regularly in this country as in Hungary and Central Russia, where it is largely cultivated. The leaves form a green fodder; the stems can be burnt for fuel or for potash, in which they are rich; and the fruits can be roasted and used for coffee, ground into meal for tea-cakes, eaten as nuts, used for poultry, pigs, and even cattle, being superior to linseed; or crushed, as they are in Russia, for oil, of which they yield 16 to 26 per cent. The oil is used for salad oil, soap-making, and painting, and the residual cake as cattle-food.

Sun Spots are dark regions, of great activity, occurring in the photosphere of the sun, and undergoing *periodic* alterations, the periods differing with different spots, but having a mean of about 11 years. These spots are of great interest on account of their agreement in time with certain magnetic phenomena on the Earth; the one grows greater or less as the other increases or diminishes. A typical sun spot consists of a black *nucleus* surrounded by a dark *umbra*, this in turn being bounded by a lighter *penumbra*, which seems of a lighter

character and often sends out arms across the intervening umbra. Probably the spot is only carrying out the general movements of vapour in the photosphere, only on a much larger scale. Huge masses of vapour force their way downwards, carving a passage for themselves, and appear dark by absorbing the light from the hotter interior. So great are the disturbances in these spots, due to enormous



SUN SPOT, SHOWING "WILLOW-LEAF" STRUCTURE.

variations in temperature and pressure, that they may be considered as capable of communicating their unsettled state to the Earth's magnetic condition. Spectrum analysis confirms the fact that great pressures occur in these spots, enormous widening of certain lines being often found, while lines displaced from their natural position in the spectrum show violent upward velocities of vapour.

Sunstroke (*Insolatio*). As a result of prolonged exposure to heat, usually from the direct rays of the sun, an attack of unconsciousness sometimes supervenes, usually attended with stertorous breathing, small frequent pulse, and great heat of the surface. The attack is sometimes quite sudden, but is usually preceded by giddiness, nausea, a sense of prostration, and other premonitory symptoms. Recovery is generally slow, and a fatal issue by no means uncommon. The most effectual treatment consists in the application of cold to the head. Counter-irritants and stimulants are sometimes employed.

Sun Worship, a form of Nature worship which in the earliest ages seems to have been more widely diffused among peoples that had risen from the condition of hunters to that of tillers of the soil, probably for the reason that the sun's influence would be more beneficial to the agriculturist than to the hunter. From the East it passed to Greece and Rome. It is frequently denounced in the Old Testament, yet from it the prophets of the Old Law borrowed much striking imagery.

Sunn Hemp, the fibre from the liber-layer of the stem of *Crotalaria juncea*, a shrubby leguminous plant, eight to twelve feet high, extensively

cultivated in India. *Crotalaria* is a large genus, with racemes of yellow papilionaceous flowers with a two-lipped calyx, heart-shaped standard petal, monadelphous stamens, and curved oblong, inflated legume. *C. juncea* branches and bears silky simple leaves. The fibre is not so soft as jute, and is chiefly used for cordage and canvas.

Superior, LAKE, is the most westerly and northerly situated of the great chain of American lakes, and lies partly in the United States and partly in Canada. Of a somewhat irregular crescent shape, it lies E. of Minnesota, N. of Wisconsin and Michigan, and S. of British America. It is 420 miles long by 160 broad, contains 31,000 square miles, has 1,750 miles of shore-line, and a depth of 79 fathoms. The N. shore is bold and precipitous, with cliffs from 300 to 1,500 feet high; the S. is sandy and low, except here and there, where are limestone ridges. One of these, the Pictured Rocks, forms a perpendicular cliff, 300 feet high. To the S. and N. are islands, the larger being to the N. and affording good shelter and harbourage, while those to the S. are smaller and without harbours. Isle Royal, the largest, belongs to the United States. The lake receives about 200 streams, and has an outlet to E. by Ste. Marie river. Rapids prevent navigation on the river, but the difficulty is avoided by canals. The waters are transparent, and there is good fishing, especially of trout and sturgeon. Copper abounds on the shores and islands.

Superposed, in botany, having one whorl of organs opposite another, instead of arranged alternately.

Supple-jack, an American name for various climbing and twining shrubs, especially the tendril-bearing species of *Paullinia* and *Cardiospermum*, belonging to the order Sapindaceæ, in tropical America, and the twining *Berchemia volubilis*, belonging to the Rhamnaceæ, in Virginia.

Supplies, a grant of money voted by a national legislature to meet the expenses of government.

Suppuration. [INFLAMMATION, PUS.]

Supra-renal Capsules, or ADRENAL BODIES, are two flattened glandular masses which lie on either side of the abdomen, resting on the upper border of the two kidneys; each capsule consists of a cortical and of a medullary portion. The function of these bodies is not understood, but they have been found in numbers of instances to be affected by degeneration in the malady known as Addison's disease, in which bronzing of the skin is associated with wasting and other symptoms.

Surat, an Indian town on the Gulf of Cambay, on the left bank of the Tapti, about 14 miles above the mouth. It extends for $1\frac{1}{2}$ miles along the river, and has in the centre a fortified castle, now occupied by public offices. A curious feature of some of the houses is that they have half-timbered projecting upper storeys. The suburbs are large and open. To the W. of the town are the military cantonments. There are some fine mosques, Mahometan tombs, Hindu and Parsee temples, churches,

clock-tower, and high school. The silted-up harbour and the rivalry of Bombay have deposed Surat from its former important position.

Surd. If the root of an algebraical expression cannot be expressed in finite terms, that root is called a surd. The sign $\sqrt{}$ is prefixed to any expression to denote its square root. $\sqrt[3]{}$ means the cube root, $\sqrt[5]{}$ the fifth root, and so on, the numbers 3, 5, etc., being called the indices of the surd. Since we cannot find a definite value for the square root of 8, $\sqrt{8}$ is a surd or an irrational number; similarly, $\sqrt{a^5}$, $\sqrt{a+bx}$, $\sqrt{a^2+x^2}$ are surds or irrational expressions. It is not always possible to tell by inspection whether an expression is irrational or not, and certain rules can then be applied for its identification. Surds are either real or imaginary; if the index of the surd be an even number, and the number under the root be negative, we have an imaginary surd. Thus, $\sqrt{-a}$, $\sqrt{-8}$, are imaginary, for no conceivable number raised to an even power can give a negative result. Although definite values cannot be given to them, they can be used in exactly the same way as any other algebraical symbols. Surds are often written without the root sign, fractional indices being used instead. Thus, \sqrt{a} may be written $a^{\frac{1}{2}}$; $\sqrt{a^3}$ may be written $a^{\frac{3}{2}}$. \sqrt{a} or $a^{\frac{1}{2}}$ is known as a simple quadric surd, while $\sqrt{a} + \sqrt{b}$ and $x + y^{\frac{1}{2}}$ are known as binomial quadric surds; they are expressions containing two terms, one or both of which are simple quadratic surds. If two binomial quadratic surds differ only in the sign connecting the term, they are said to be conjugate, and their product is the difference of the squares of the respective terms. Thus, $\sqrt{x} + \sqrt{y}$ and $\sqrt{x} - \sqrt{y}$ are conjugate, $x - y$ being their product. All the laws of indices are obeyed by surds as well as by rational expressions. [INDICES.]

Surface Tension. If we try to mix oil and water on a plate, we find that they will separate directly they are left alone. The two liquids have therefore done work in order to separate, and have lowered their energy; the tendency was to decrease the surface between them as much as possible. Hence decrease of energy and decrease of surface take place together, or, looking at it from the other point of view, the greater number of particles existing in the surface the greater is the energy of the liquid; so that we may draw the conclusion that a particle of liquid has more energy when in the surface than when far from it. This energy is known as *surface energy*, and is proportional to the area of the fluid surface. The energy of the two surfaces of a soap-bubble is equal to the work done in blowing the bubble, but it is usually stated in the form of the energy per unit area. Surface energy is not always the same for any fluid, but depends on the other substance which meets it at that surface. With

the same two non-mixable fluids, however, the surface energy is a fixed quantity. The surface of a fluid is exerting a tension in all directions, and it is the action of this force which causes the contraction of the surface and the lowering of the energy of the fluid. It is usual to consider this force as acting across a line of film and to express it as the force per unit length. It can then be shown that this force per unit length, or *surface tension*, is equal to the energy per unit area, and the surface tension also depends upon the nature of the two fluids bounded by the surface. When three fluids can exist in contact with each other, the surface tensions for each pair are three forces in equilibrium, and their values determine the angles between the three surfaces. The same three fluids always meet at the same angles. If the surface tension between two is greater than the sum of the surface tensions between the other two, there cannot be equilibrium. This is the case when air, water, and oil are the three fluids; the surface tension of water in contact with air is so much greater than the sum of the tensions between air and oil, and between oil and water, that the oil is pulled out. It tries, in fact, to cause the last two surface tensions to act in one line, so that their resultant shall be as great as possible, and thus tends to make the surface between water and air and that between oil and air lie in one plane. This occurs when the angle between oil and water is reduced to zero—*i.e.* when the oil is drawn out into an infinitely thin film. Surface tension also acts when a fluid is in contact with a solid. A liquid in a fine capillary tube is in contact with the solid tube and with the air, and as long as the surface tensions between pairs of the three substances are in equilibrium, the surface of the liquid will make a definite angle with the tube. [CAPILLARITY.]

Surgeons, ROYAL COLLEGE OF, an institution founded A.D. 1400 for the training and licensing of qualified practitioners in surgery and medicine. The collegiate buildings are in Lincoln's Inn Fields.

Surgery. The art of surgery had already attained a high degree of development in many countries some centuries before the Christian era, as is evidenced by Sanscrit manuscripts and the works of Hippocrates, and to a less notable extent by Egyptian and Chinese writings. The Hindoos and Greeks were familiar with, and described, most of the forms of fracture and dislocation which are recognised at the present day. The operations of laparotomy and lithotomy were occasionally performed by them; aneurism and the forms of hernia were recognised. The want of knowledge of anatomy, due to the fact that systematic dissection was not practised, and the absence of satisfactory methods of dealing with bleeding vessels, considerably limited, however, the scope of the operator in ancient times. A compendium of the surgical knowledge which grew up in the course of succeeding centuries is furnished in that part of the work produced by Paulus of Ægina which deals with surgery. This book was written in the 7th century A.D., and for some centuries after its appearance but little further progress resulted. The more

remarkable additions to surgical practice date from comparatively recent times. The growth of knowledge with respect to anatomy and physiology in the 17th and 18th centuries led to a great advance being made, the names of Wiseman, who lived in the 17th century, and of John Hunter, who lived in the 18th century, being especially noteworthy among those of Englishmen who contributed to this advance. In the 19th century the discovery of anæsthetics revolutionised surgical practice, and acceptance of the germ theory of disease and development of the antiseptic treatment of wounds have in recent years worked remarkable changes in the scope and results of operative treatment.

Surgical Dressings. [SLINGS, SPLINTS, LINT.]

Surinam Toad (*Pipa americana*), a large toad found in Surinam, remarkable for the fact that the young undergo their metamorphosis in cells on the back of the female.

Surplice (*super-pellicium*), a loose vestment of white linen with full open sleeves, fastened in front at the throat, and falling down all round the figure. It is worn during Divine service by deacons and priests and choristers and acolytes in the Latin and Anglican Churches and by members of the colleges of some English universities. The Latin surplice is shorter than the ordinary Anglican surplice, is often ornamented with lace or made of lace, and is worn over a cassock. The short Italian surplice as worn by acolytes and choristers is called a *cotta*.

Surrey, an inland southern county of England, having the Thames on the N., Sussex on the S., Kent and London on the E., and Hampshire on the W. The surface is for the most part varied, and is traversed from E. to W. by the North Downs, which rise in the outlying spur of Leith Hill to a height of 965 feet. The N.W. consists of heath and moorland overlying the London clay. The Downs are chalky, while the S. is greensand and wealden. With the exception of the Arun and the Upper Medway, the rivers drain into the Thames. Other rivers are the Mole, which flows through a picturesque valley, the Wey, and the Wandle. The Basingstoke Canal is fed by the Wey. The Grand Surrey Canal leads from Camberwell to the Thames at Rotherhithe. The nearness of London and the fitness of Surrey as an abode for London toilers causes the county to be well served with railways. The soil is very varied, and the crops vary accordingly. In the neighbourhood of London are kitchen and market gardens, while farther out are medical, herbal, and perfumery gardens. Good hops are grown in the Farnham district. Except in Southwark and other London districts, there is no important manufacture. Chief towns, Guildford, Croydon, Kingston-on-Thames, Godalming, Reigate, and Dorking, noted for the fine scenery in the neighbourhood. The county is divided into six Parliamentary districts, with one member each.

Surveying is the science of measuring the shape and size of any portion of the earth's surface in order that a map or plan may be drawn. The area to be surveyed is divided up into a number of triangles, whose sides and angles are measured: the

area can be calculated from the figures so obtained, and a plan can be made by reproducing the triangles on a reduced scale. The simplest appliances for the purpose consist of a chain and cross-staff or optical square. By means of the former the lengths of the sides of a triangle may be determined, and with the aid of the latter a perpendicular may be drawn from the bases to the apex of the triangle. From the observed lengths of the sides and the perpendicular, the area of the triangle can be ascertained, and it is evident that the area of a plot of land is the sum of the areas of the triangles into which it has been divided. For more extended surveys optical instruments for measuring angles are used. Three points are selected, and the distance between two of them is measured by a chain or otherwise. The angles between this base-line and the lines joining its extremities with the third point are then measured, and from these three measurements the area of the triangle may be calculated, as also the lengths of the two sides. Either of these sides may now be used as the base of a second triangle, and this process of triangulation may be repeated to any required extent.

Susa, a town of ancient Persia, was the capital of Susiana, and contained the winter palace and treasury of the Persian kings, these being enclosed by a fortified citadel. The city was quadrangular, is mentioned in the Book of Daniel and by Pliny, and seems to have been watered by many streams, feeders of the Choaspes, on whose eastern bank it was situated. Its site is occupied by mounds, and bricks, pottery, cuneiform inscriptions, and other relics of the ancient city have been found.

Susanna, the chief character of an apocryphal book of the Old Testament, originally inserted by a Greek writer in the text of Daniel. She is falsely accused of unchastity by certain elders, but rescued from death through the judgment of Daniel.

Suspension, **AXIS OF**, is the line perpendicular to its plane of motion, about which a pendulum swings. In considering a section of the pendulum by this plane, the axis reduces to a point called the centre of suspension. [PENDULUM.]

Suspensor, in botany, the chain of cells at the end of which the developing embryo is situated.

Susquehanna, a river of the United States, is formed by two branches, the main branch, from the N., rising in Otsego Lake, New York, and the other rising in the Alleghanies. The two streams unite at Northumberland (Pennsylvania), and the river flows S.E. past Harrisburg and Columbia into Maryland, and falls into Chesapeake Bay at Hâvre de Grâce. The main channel is 250 miles long.

Sussex, a maritime county, south of England, has Surrey on the N., the English Channel on the S., Kent on the E., and Hampshire on the W. The surface is undulating, and somewhat flat in parts, but in the S. the South Downs pass through from E. to W., their most eastern point being Beachy Head. They rise to a height varying from 400 to 900 feet, but the highest point in the county is Blackdown in the extreme N.W. Sussex is

scantily supplied with rivers, the only ones being the Ouse, the Arun, the Adur, and the Rother. Heavy grain crops are grown in the S., and the marshes give a supply of good hay, and in the E. hops are grown, but there is nothing particularly characteristic about the remaining crops. The South Downs are noted for their breed of sheep, whose flesh is said to owe its excellence as mutton to the fine air and sea-breezes of the Downs. Sussex is well wooded, there being about 122,000 acres of wood in all, among which comes what is called the Forest Ridge, containing St. Leonard's Forest and Ashdown Forest, the two comprising 24,000 acres. All this region of the Weald is rich in ironstone, and till last century the Sussex iron had a great reputation. Hammer ponds, scattered here and there, are now the only relics of the forges. Newhaven, at the mouth of the Ouse, is utilised by the London, Brighton, and South Coast Railway as a port of embarkation to France. The fine climate of the southern coast gives it a special advantage as a place of residence, and Brighton, Eastbourne, Hastings, Worthing, Bognor, and other spots on the coast are well-known sea-bathing places. Sussex has no special manufactures at the present day, though some ship-building goes on at Shoreham, at the mouth of the Adur. The county is rich in historical associations, easily aroused by the names of Battle, Hastings, Lewes, Pevensey, Rye, Winchelsea, and it is dear also to the antiquary and archæologist. There are interesting castles at Arundel (still inhabited), Hastings, Lewes, Pevensey, Bramber, etc., and many picturesque seats, Petworth being one of the best-known. The capital is Chichester. The county has six Parliamentary divisions, each returning one member.

Sutherland, a county in the N. of Scotland to the W. of the North Sea, and having Pentland Firth on the N., Ross on the S., Caithness on the N.E., and North Minch on the W. It forms part of the N.E. peninsula of Scotland, and is about 50 miles long and broad. The coast to the W. is bold and precipitous, and much indented, but that on the E. is flat and sandy, save where Ord juts into the sea at the junction of this county with Caithness. The interior is mountainous, and has fine glens and valleys. The highest point is Ben More (3,273 feet). The rivers drain N.E. and W. and are of no great importance, but afford good fishing. The lakes are many, and some large, the largest being Lochs Shin (16 miles long), Naver, Hope, Assynt. There is much old red sandstone in the county and a wonderful coal-measure, well-nigh useless for fuel, and connected with this are lias and oolite, almost peculiar to this spot of Scotland. The indigenous trees are birch, alder, and oak, but there are many plantations. Grazing is the chief occupation, and many potatoes are grown. The late Duke of Sutherland reclaimed much waste land. The county is represented in Parliament by one member.

Sutlej, one of the five rivers that give its name to the Punjab, of which the Sutlej forms the E. boundary. The river comes from a lake in Thibet at a height of 15,000 feet, and flows through stupendous scenery as a rapid torrent, leaping from

point to point, sometimes falling 150 feet in a mile. After a course of 150 miles W. to Nako, it flows S.S.W. through the Himalayas and to the E. of the Punjab, receiving many tributaries, till, after a course of 900 miles, it falls into the Indus.

Suttee (Sanskrit, *satī* = "good woman"), properly, a Hindoo widow who is burnt alive on her husband's funeral pile; usually the Hindoo rite of widow-burning. This practice has been suppressed under the British *raj*.

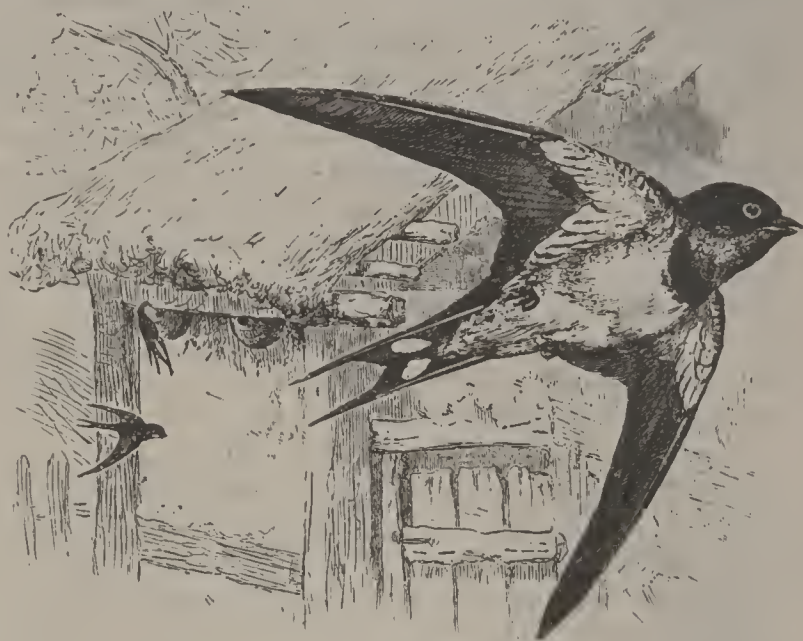
Suture. [For the cranial sutures, see SKULL.] The term "suture" is also applied to the materials employed and the methods adopted in bringing into apposition the cut surfaces of wounds.

Suwaroff, or SUVOROFF, ALEXANDER VASILIEVICH (1729-1800), Russian general, was born at Moscow. He distinguished himself in the Seven Years' War, the Polish War of 1768-71, and the two wars against Turkey (1773, 1789-90). The Polish War of 1794 was brought to a close by his capture of Praga, a suburb of Warsaw. After the death of Catherine he lived for a time in disgrace in Novgorod, but in 1799 he was placed in command of the army sent to operate against the French in Italy. He defeated Moreau on the Adda, Macdonald on the Trebbia, and Joubert at Novi, but, owing to the success of Massena, failed to follow up these advantages in Switzerland. He retreated into Russia through Bavaria, dying soon afterward.

Swabia (German *Schwaben*), so called from the *Suevi* who inhabited it of old, is an ancient German duchy. It, together with Bavaria, formed the kernel of the newly-formed Germany (843). In 1376 was formed the Swabian League, and in the 14th century it formed the south-western and most fertile part of Germany. It had on the E. Bavaria, and the Rhine separated it from Switzerland on the S. and from France on the W. Swabia, which contained 13,000 square miles and had for its capital Augsburg, is now divided among Württemberg, Bavaria, Baden, Hohenzollern, and Lichtenstein.

Swahili (WA-SAHILI, "Coast People," from Arabic *sahel* = "coast"), the mixed Arabo-Bantu Mohammedan populations of Zanzibar and neighbouring mainland from Mombasa nearly to Mozambique. Amongst upper classes the Arab type is more pronounced, and many even claim pure Arab descent. But all the rest are a hybrid people, the outcome of continuous interminglings with all the tribes of the interior represented by the convoys of slaves for ages brought down to the coast and gradually absorbed in the Mohammedan families. Their language also, although preserving its original Bantu structure, is largely affected by the Arabic element, and is written both with the Arabic and the Roman alphabet, the Mohammedans using the former, the Christian missionaries the latter. Thanks to the enterprising spirit of the Wa-Swahili, who traverse the interior in all directions as traders, slave-hunters, caravan leaders, and carriers in the service of the Europeans, this Ki-Swahili language has become the chief medium of intercourse throughout a great part of the continent as far west as the Upper Congo and from Uganda to Nyassaland.

Swallow, a book name for a cosmopolitan family (*Hirundinidae*) of Passerine Birds, and for its type-genus (*Hirundo*). There are several genera, and about 100 species, mostly insectivorous birds, that take their prey on the wing, though some feed on berries. The wings are long and pointed, the legs and feet small, and the tail usually forked. The type-genus, with the range of the family, has about forty species, three of which visit Britain in the summer. The Common or Chimney Swallow (*H. rustica*) arrives about the middle of April, and is looked upon as the harbinger of summer. The



SWALLOW (*Hirundo urbica*).

length of the adult male is about eight inches, of which the deeply-forked tail counts for five. The upper surface and a band across the chest are glossy blue-black, the forehead and throat chestnut, and the under parts buffy white. The hen-bird is a little smaller. The nest of mud and clay is lined with feathers, and there are usually two broods in a year. These birds assemble in large flocks in autumn before migrating south. The House-Martin, or Window Swallow (*H. urbica*), may be distinguished by its smaller size, the white patch on the rump, and the absence of the chestnut on the throat, and of the blue-black band on the breast. The feet are covered with downy feathers. The Sand-Martin (*H. riparia*) is the smallest of the three, and arrives first. The plumage on the upper surface and on the breast is brown, and white beneath. The toes are not feathered. The nest is placed at the end of a gallery excavated in sand-banks, cliffs, river-banks, and similar situations. [SWIFT.]

Swallowing. [DIGESTION.]

Swallow-tailed Butterfly, any member of the family *Papilionidae* having lengthened processes of the hind wings, making a form resembling a swallow's tail.

Swan, any bird of the genus *Cygnus*, of the Duck family, of which they are the largest members. There are about ten species, chiefly from the temperate regions of the northern and southern hemispheres. The bill is about as long as the head, and the neck is long and arched; the short legs are set far back, and give these birds an ungainly appearance

on land, though they are exceedingly graceful in the water; the three toes in front are webbed, and the hind toe is free. They feed principally on aquatic vegetation, but they also consume great quantities of fish-spawn. Their usual note is a loud hiss, but the call of the male in the breeding season is a trumpet-like note. The Common Mute, or Tame Swan (*C. olor*) is partially domesticated as an ornamental bird in this country and on the Continent. The total length is about five feet. The plumage of the adults is pure white, but that of the young birds or cygnets is bluish-grey. The Polish Swan (*C. immutabilis*) is now reckoned a variety, though formerly considered distinct, from the fact that the plumage of the cygnets was white. The Wild Swan, Elk, or Whooper (*C. ferus*) and Bewick's Swan (*C. bewicki*) visit Britain in their migration southward. The North American Swans, like those of Europe, are white-plumaged. The Black-necked Swan (*C. nigricollis*) is South American, and the Duck-billed Swan (*C. anatoïdes*), from Magellan Straits, has the head and neck brown. The Black Swan (*C. atratus*) is Australian. Swans are birds-royal, and to steal a tame swan or one bearing the mark of the Crown is felony.

Swansea, a seaport and parliamentary borough (one member) of Glamorgan, is situated at the mouth of the Tawe—whence its Welsh name *Aber-tawe*—on Swansea Bay to the N. of the Bristol Channel. The ancient town consisted of a few narrow streets at the mouth of the river, defended by a castle, now ruined; but the modern town faces the bay, and its sands, parks, and pure water-supply make it a great place of resort. Its proximity to the coal-fields gives it great facility for carrying on its chief industry of copper-smelting. Tin-plate, lead, zinc, iron, steel also are worked. More than a million tons of coal and patent fuel are exported yearly by sea and by the three railways that serve Swansea. The tonnage of vessels entered and cleared annually amounts to more than a million. The extensive docks are divided into North, South, Beaufort, and Prince of Wales' Docks. Among the many good public buildings are the Town Hall and the Royal Institution. The market is in the centre of the town.

Swaziland, a native state of South Africa, lies to the W. of the Libomba Mountains, and occupies the S.E. corner of the South African Republic, extending almost to the Drakensberg Mountains on the W. It contains 6,150 square miles, and the majority of the inhabitants are Swazis, a people of Zulu origin. The independence of Swaziland was acknowledged in 1884, but the white settlers and miners are governed by joint British and Boer authority. There is some trade through Natal and Delagoa Bay, and the natives smelt copper and iron, and make good wood-carvings.

Swearing. [CURSING, OATHS.]

Sweat. The sweat or fluid of perspiration contains about 5 parts of solids in 1,000 parts. These solids consist of mineral salts, extractives, fatty substances, and certain organic acids. The sweat is excreted by the sweat glands. [SKIN.]

Sweating, in certain trades, strictly means sub-contracting—i.e. instead of hiring workers directly, "putting the work out" through middlemen, who make their profits by cutting down the wages paid. More loosely, it is applied to the system of paying for piecework at so low a rate that starvation can only be kept off by overwork.

Sweating Sickness, an epidemic disease which committed great havoc in this country in the 15th and 16th centuries. It appears to have in some degree resembled influenza.

Swede, originally known, from the country of its origin, as the Swedish turnip, is *Brassica campestris*, var. *Rutabaga* or *Napo-brassica*. It is a most valuable food for sheep, yielding far heavier crops than the common turnip. Its introduction in the 17th century effected a revolution in our agriculture. The swede flourishes in the moist summers of the north of Britain, but suffers much from the attacks of the turnip-beetle.

Sweden, a kingdom of Europe, occupying the eastern, the more fertile and populated, part of the Scandinavian peninsula. It lies between lat. 55° 20' 18" and 69° 3' 21" N., and long. 28° 46' 8" and 41° 44' 23" E., and is bounded by Norway and Russia on the N., by Norway, the Cattegat, and the Skagerrak on the W., by the Baltic on the S., and by the Baltic, the Gulf of Bothnia, and Russia on the E. It has an area of 170,644 square miles: its longest line measures nearly 1,000 English miles, the greatest breadth being 280 miles. The length of the coast-line is about 1,550 miles.

Physical features. Only the northern and north-western parts of Sweden can be called mountainous. About one-third of the area of the whole country lies lower than 300 feet above the level of the sea, and scarcely a twelfth part lies higher than 2,000 feet above the sea. From the Kjölen range, which forms the boundary between Norway and Sweden, the country stretches as a broad plain, sloping towards the Gulf of Bothnia on the east and towards the large lakes and flat districts in the southern provinces. The most important range of mountains commences on the Norwegian border near Lake Fæmundsö, and extends first in an easterly and afterwards in a southerly direction through the whole of Central and South Sweden down to Scania, the most southerly province. Near the Norwegian border is situated Sulijelma, the highest peak in Sweden (6,000 feet). The central part of the country is a land of large and extensive lakes, occupying about an eighth of the total area. The most important of these are the Vener, Vetter, Mälar, and Hjelmar lakes. They are connected by rivers and canals, and communicate on the west with the Cattegat and on the east with the Baltic. Sweden is rich in rivers, the largest being the Ängerman and Götaelf. On the latter, and not far from Gothenburg, is the celebrated waterfall, the Trollhättan. Geographically and politically, Sweden is divided into three divisions—Norrländ, Svealand, and Gothland. The first is full of large forests and mountainous districts, through which run numerous streams and rivers. The

Laplanders (a Mongolian race), with their reindeer, chiefly inhabit this part of the country, where a large number of wild animals—reindeer, bears, wolves, foxes, many kinds of birds of prey, game birds, ptarmigan, snipes, etc.—abound. In Svealand, the central part, the large lakes and large tracts of forests are found. This part is also known for its large iron and copper mines. Gothland is the most southerly division, and contains the best and the greater part of cultivated land in Sweden. The fundamental rocks of Sweden consist mostly of crystalline gneisses and granite of the Azoic period, and may be classed into three divisions—the grey gneiss, the red iron gneiss, and the granulite. The iron deposits occur in more or less fine-grained gneiss or granulite. Gold, silver, copper pyrites, and zinc blende are also found in the country. During the Glacial period Sweden was wholly covered with ice, and the most recent deposits date from that period. The Skärgård is a collection of small and low islands, or skerries, on different parts of the coast.

Climate. The climate of Sweden varies very much on account of the great extent of the country from north to south. In the northern parts and along the Norwegian border the winters are very severe. On the eastern coast the winter is much colder than on the western. The south of Sweden enjoys, as a rule, long and warm summers, but both summer and winter are in all parts liable to great fluctuations from year to year.

Population; Industries and Commerce; Communications. The population of Sweden has increased steadily during the last hundred years. In 1893 there were nearly 5,000,000 inhabitants, of which 17,000 were Finns, 6,400 Lapps, and 3,000 Jews. The greater part of the population, about 80 per cent., live in the rural districts. The largest towns are Stockholm, Gothenburg, Malmö, and Norrköping. Agriculture is the most important industry of the country, although only 8 per cent. of the total area of it is under cultivation. In the southern districts the crops consist principally of rye, barley, wheat, and potatoes, in the less fertile districts of oats, which of late have found a good market in England. The country produces more corn than it consumes; it has also a large export of butter to England. The forests (mostly pine and fir) occupy more than half of the entire area, and timber is therefore one of the most important articles of export. About one-half goes to English ports. Mining is also one of the great industries of Sweden, and gives employment to about 34,000 persons. Of the iron-mines those of Dannemora in Upland, Norberg in Westmannland, and Grängärde in Dalarne are the most important. There are also several copper, zinc, nickel, and silver-mines in the country. The inhabitants on the coast and the small islands, the Skärgård, are mostly fishermen. Herrings, sprats, salmon, mackerel, haddock, and cod are the principal fisheries. During the last 50 years the other industries of Sweden have grown considerably and rapidly. The most important branches are ironworks, foundries, cotton and paper mills, sugar refineries, breweries, clothing and tobacco factories, tanneries, match manufactories, glass and porcelain works, etc. The

trade and shipping have also made great progress during the last half-century. The country possesses a merchant fleet of 3,822 vessels of about 500,000 tons burden. The exports from Sweden in the same year amounted to £15,500,000 sterling, and the imports to £18,000,000. Sweden has an excellent and extensive system of roads, railways, canals, and telegraphs.

Government; Army and Navy; Finance. Sweden is a constitutional monarchy, united with Norway since 1814 under one king, in whom the executive power is vested. The king is advised by a Council of State, consisting of ten members, and shares the legislative power with the *Riksdag*. There are two chambers in the National Assembly, the members of the first being elected for nine years by provincial councils and by the municipal councils of some of the large towns (one member for every 30,000 inhabitants). Candidates for the first chamber must be 35 years of age and possess property to the amount of at least £4,500. The members for the second chamber are elected for three years, one for every rural district of less than 40,000 inhabitants, two for every district with a population exceeding that number, and one for every 10,000 in the towns. The right of vote for the second chamber belongs to every male adult who possesses property to the amount of £55, or for at least five years has held a lease of property valued at least at £330, or who pays taxes on an income of and above £45 a year. The members of the second chamber are paid, while the members of the first receive no remuneration. The 24 *läns*, or provinces of Sweden, and the city of Stockholm are administered by a *Landshövding*, or governor, and a provincial council. For the purpose of collecting taxes and the preservation of peace, the *läns* are divided into altogether 117 *Fogderier* or bailiwicks. The parishes and towns have a large measure of self-government vested in their local, parish, or town councils. For judicial purposes the country is divided into *härads*, or districts, each administered by a *häradschef*, or president, and 7 to 12 *Nämndemän* or jurymen, generally elected from among the peasant proprietors of the district. In the towns the judicial authority is vested in the magistrate. There are three superior courts of justice—*Svea Hofrät* in Stockholm, *Gotä Hofrät* in Jönköping, and *Skåne and Blekinge Hofrät* in Kristianstad. The highest court of appeal is the king's *Högsta Domstöl* in Stockholm. In Sweden trial by jury is only legalised in cases of offences by the press. The army consists of a standing army and a militia. The first is recruited from men, who are enlisted for 3 to 4 years and from a class, called the *Indelta*, who receive a yearly pay and a free cottage. In times of peace the standing army numbers about 36,000 men and 1,700 officers. The number available in war is unknown. The militia is made up by conscription of all able-bodied men in the country, who are obliged to serve from the age of 21 to 33. The militia numbers about 125,000 men. The navy consisted in 1891 of 17 ironclads, 15 gunboats, and a considerable number of unarmoured steam-vessels, torpedo-boats, and training vessels, manned in all by 3,290 men and

760 officers. The king is the highest in command of the army and the navy. The public revenue, in 1893, amounted to £5,390,000, which balanced the expenditure.

Character of the People : Religion and Education. The Swedish peasantry is a hardy, intelligent, and industrious people, very religious and loyal to their sovereign. The State religion is that of the Lutheran Church, ruled by the Archbishop of Upsala and eleven bishops. Nearly the whole of the population belongs to the State Church. At present there are only about 35,000 Dissenters (Baptists, etc.) and about 3,000 Jews. Sweden stands high in education, which is compulsory but free. Besides excellent elementary schools, there are numerous high and technical schools and two universities (Upsala and Lund).

History. Sweden has only gradually acquired its present boundaries, and developed into one complete state. The southern part (Scania, Halland, and Blekinge) was originally united to Denmark; other parts (Bohuslän, Jämtland, and Herjedal) have at times belonged to Norway, at other times to Sweden. The country was first inhabited by the Lapps, who, according to Montelius, about 1500 B.C. were driven into the forests in the northern part of the country by two invading Teutonic races, the *Gautar*, or Goths, who settled in the south (Gothland), and the *Svear*, or Swedes, who settled in the central part of the country around the great lakes (Svealand). Their manners, customs, and language were the same, but at the dawn of Swedish history we find them at war with one another, and the enmity continued till they, in the 13th and 14th centuries, gradually melted into one nation. In 1397 Sweden became one of the confederate kingdoms of Scandinavia (Denmark, Norway, and Sweden) under the Treaty of Kalmar, but this union only brought Sweden trouble and disaster, and was at last blotted out by the fearful massacre of Stockholm in the reign of Christian II. (1520). At this time Gustav Vasa came to the fore as the saviour of his country; he succeeded eventually in driving the Danes out of the country. He was elected king in 1523, and reigned for 41 years, during which time the country prospered and made great progress. His successors were less fortunate in maintaining peace in the country, till at last the great qualities of the founder of the Vasa dynasty revived in Gustavus Adolphus II., whose name as a statesman and general soon became known throughout Europe, and who eventually lost his life on the battlefield of Lützen. During the reign of his son, Charles XI., and his immediate successors, Sweden was again troubled with internal strife and discord, and lost also several of its provinces beyond the sea—Bremen, Verden, Hither-Pomerania, Livonia, Esthonia, etc. Thus Sweden fell from the rank of a leading Power, which it had held for nearly a century, till the gifted Gustavus III. in 1772 put an end to the deplorable state of affairs and reframed the constitution. He was a great patron of learning, and founded the Swedish Academy. His war with Russia (1788–90) brought the country, however, only loss and no advantages. In spite of his ability and all he did for Sweden, he could not be

called a wise or successful king. Under his two successors the misfortunes of Sweden came to a final end by the loss of Finland in 1809. In 1810 Bernadotte, the well-known French general, was adopted by the feeble and childless Charles XIII. as heir to the Swedish Crown, and succeeded in 1818 the latter as Charles Johan IV. In 1814 Sweden entered into the present union with Norway under one king, each country remaining a free and independent kingdom with its own constitution, government, parliament, army, etc. Since then Sweden has enjoyed uninterrupted peace, and has made splendid use of the opportunity for improving the country in every respect. It may now well be counted among the most happy and prosperous countries in Europe. On the death of Charles Johan in 1844 his son, Oscar I., succeeded to the throne, who again was succeeded by his eldest son, Charles XV. During his reign an important reform in the constitution took place. Instead of the four *Ständer* or estates of the realm—that of the aristocracy, the clergy, the burghers, and the peasants—the Diet was divided into two chambers—the first and the second chamber. Charles XV. died in 1872, when his brother, the present king, Oscar II., ascended the throne.

Literature. The oldest productions in the Swedish language are a series of manuscripts of common laws or codes, some folk-songs, etc. The first printed book in Swedish appeared in 1495. The 16th century added but little to the literature of the country, but the reign of Adolphus II. was adorned by one great writer, Georg Stjernhjelm (1598–1672), “the father of Swedish poetry.” After the king’s death he was attached to the Court as poet-laureate by Queen Christina. A more brilliant period followed the death of Charles XII., to which belonged Olaf von Dalin (1708–63), a writer of great elegance in prose and verse, Hedwig Charlotta Nordenflycht (1718–63), a graceful poetess, and the two poets Gustaf Creutz (1729–85) and Gustaf F. Gyllemborg (1731–1808). Karl von Linné or Linnæus (1707–78), the great scientist, wrote almost entirely in Latin, and Emanuel Swedenborg (1685–1772), the visionary, wrote also in the same language. The so-called Gustavian period (1771–1809) was rich in literary talent. The Swedish Academy was founded, and literature began to partake more of a national character. In 1773 the National Theatre in Stockholm opened with an opera written by the king himself. To this period belong: Anna Maria Lenngren (1754–1817), a popular writer of verse, Karl Mikael Bellman (1740–95), one of the most original and popular of Swedish poets, and Johan Henrik Kellgren (1751–95), a writer of great power and versatility. Frans Mikael Franzén (1772–1847), the great lyrical poet, fills up the space between the Gustavian and the Romantic period. In the early part of the present century appeared the works of Erik Gustaf Geijer (1783–1847), the famous historian, and of Essaias Tegnér (1782–1846), the well-known poet. The latter’s *Frithjofs Saga* is known in England through several translations. Erik J. Stagnelius (1793–1823) and Erik Sjöberg (Vitalis) (1794–1828) were two gifted poets, whose works are still much read.

The first prosaist of the time was Karl J. L. Almqvist (1793-1866), and the most popular novelist Fredrika Bremer (1801-65), whose stories are translated into all European languages. Anders Fryxell (1795-1881) was the most popular of all Swedish historians. Of the last generation of writers Johan Ludvig Runeberg (1804-77) stands highest as a poet of the first rank, Wilhelm von Braun (1813-60) as a popular lyricist, and August Theodor Blanche (1811-68) as a popular dramatist and novelist. Other novelists of reputation are Emilie Flygare Carlén (b. 1807) and Maria Sofia Schwartz (b. 1819). Z. Topelius (b. 1818) is also a popular and highly-successful novelist and poet. The most recent school of writers consists of A. Strindberg (q.v.), novelist and dramatist, Anna Charlotta Edgren (1849-92), a highly popular novelist and dramatist, Tor Hedberg (b. 1861), G. von Geijerstam (b. 1858), novelist, Fru Agrell (b. 1849), dramatist, and several other rising poets and writers of fiction. One of the first living Swedish authors is undoubtedly Viktor Rydberg (b. 1829), a writer of masterly novels and historical romances.

Ethnology. Of the 5,000,000 inhabitants of Sweden (1890), all but 17,000 Quains (Finns), 6,400 Lapps, and about 20,000 foreigners (Norwegians, Danes, Germans, Russians, etc.) are *Svenskar*, true Swedes, descendants of the *Gautar* and *Svear*, two kindred Low German peoples in occupation of the southern districts since the Bronze epoch. Throughout the historic period the country appears to have remained in almost exclusive possession of these first immigrants, who, after many ages of incessant struggles for the ascendancy, were at last merged in a single homogeneous nationality towards the middle of the 13th century. The inhabitants of Sweden are thus one of the most uniform in Europe, being essentially Low Germans in physique, speech, and traditions, and presenting no differences traceable to the two original elements, except perhaps some local usages and provincial dialects. Such contrasts are most pronounced amongst the Dalecarlians of the Upper Dal basin, best representatives of the *Svears* as opposed to the *Gautar* or "Goths" of the extreme south. Physically the Swedes are tall (mean 5 feet 10 inches), with slim figure, stout frame, oval head, broad open forehead, regular features, deep blue eyes, florid complexion, frank and perhaps somewhat haughty expression. They are a brave, lively, and courteous people, the "French of the North," as they are fond of calling themselves. Intellectually they yield to none, and display a marked aptitude especially for the physical and natural sciences, as shown by such names as Linné, Fries, Celsus, Berzelius, Retzius, and many others. The Swedish language, a direct descendant of Old Norse, appears to have taken decided shape about the 13th century, from which period date the oldest extant national songs and laws of the land. It has been sedulously cultivated, especially since the Reformation, and is distinguished from the sister Dano-Norwegian tongue by greater harmony, a distinct musical accent or intonation, and some minor grammatical features. Outside Sweden it is current on the south-west and west coast of

Finland, where the Swedes have been settled in compact masses for several centuries. J. L. Runeberg, perhaps the greatest of Swedish poets (ob. 1877), was a Finlander.

Swedenborg, EMANUEL (1688-1772), founder of the "New Church signified by the New Jerusalem in the Revelation," commonly known as the Swedenborgians, was born at Stockholm, the son of Jesper Svedberg, who afterwards became Bishop of Skara. After studying at the university of Upsala, he travelled in England, Holland, France, and Germany (1710-15), receiving from Charles XII. on his return the appointment of assessor in the Swedish college of mines. In 1719 the family was ennobled, its name being changed from Svedberg to Swedenborg. The *Opera Philosophica et Mineralia* (1734) entitles Swedenborg to rank high among natural philosophers and original thinkers, although it carries speculation far beyond the limits warranted by experience. Absorbed in the effort to discover the ultimate explanation of the physical and spiritual world, his views became ever more visionary, and in 1745 he believed he had received a special revelation, communicated to him by the Lord Himself, which it was his duty to make known to his fellow-men. Much light has been thrown on the circumstances attending this vision, which took place in London, by the *Diary* first published in 1858. Swedenborg resigned his civil employment in 1747, and henceforward divided his time between Sweden, England, and Holland, devoting himself entirely to the composition of his theological works. The *Arcana Cœlestia* (8 vols., 1749-56) contains a summary of his principal views, including the doctrine of correspondences, according to which everything good or bad in the natural world has its counterpart and explanation in the spiritual life of man. He applies this doctrine to the explanation of the Bible, regarding water, for example, as equivalent to truth, but only parts of the Scriptures commonly received as canonical are susceptible of this interpretation. Swedenborg firmly believed that he enjoyed free intercourse with angels and departed spirits, and gave a full description of the abodes of the blessed in heaven. On several cardinal points of Christian doctrine his views were decidedly unorthodox. He affirmed that the Last Judgment had visited the world in 1757, and that by Christ's second coming was meant the new dispensation which began with the foundation of the "New Church."

Sweet Potato (*Ipomœa Batatas*), a convolvulaceous plant, is unknown in a wild state, but is extensively cultivated throughout the tropics and in Southern Europe. We import small quantities from Spain. Its tubers reach a far larger size than those of the potato (q.v.), from which they also differ in containing 3 per cent. of sugar. They weigh about four or five pounds each. An allied species, *I. chrysorrhiza*, is the "kumarah" eaten by the Maoris.

Sweet William (*Dianthus barbatus*), a pink belonging to the south of Central Europe, from the Pyrenees to the Balkans and Carpathians, is an

old-fashioned garden favourite. It has broad, glabrous leaves and corymbose fascicles of flowers, less individually than an inch across. The petals are toothed, and are of various shades of red with dots and rings of white or other shades of red.

Swift, any bird of the Picarian family *Cypselidae*, or of its type-genus *Cypselus*. These birds are remarkably swallow-like in appearance and habit, but their close relationship to the humming-birds is shown by their structure. The family, which contains seven genera, with about 50 species, is almost cosmopolitan, New Zealand being the only sub-region in which none is found. The bill is short and weak, the wide gape is fringed with bristles, the wings are long and pointed, and the tail is short. There are two groups:—(1) The True Swifts, in which all the toes are directed forwards; (2) those in which the first toe is directed backwards. In this last group the tail-feathers are mucronate, whence the species are often called Spine-tailed Swifts. The Common Swift (*C. apus*) is found pretty plentifully in summer over the north of Europe and Asia, arriving later and leaving earlier for its southern winter quarters than the swallows. The general plumage is a brownish-black, glossed with bronze, and there is some white on the throat. The long wings are sickle-shaped, and from their rapid flight these birds derive their popular name. Their chief food consists of insects, and they reject the hard parts in the form of pellets. The nest is formed of bents, dried grass, feathers, etc., cemented together with a glutinous secretion. There are usually but two eggs, and more than one brood in a season is the exception. The Alpine or White-bellied Swift (*C. alpinus*) is a rare British visitor, though it spends the summer among the mountains of Central and Southern Europe. The Swiftlets (*Collocalia*) make the edible birds'-nests (q.v.), and some other members of the family use salivary secretions in nest-building.

Swift, JONATHAN (1667–1745), greatest of English satirists, was born of English parents at Dublin on the 30th of November, 1667, being remotely related on his mother's side to Herrick, and on his father's to Dryden. By the death of his father, seven months before his birth, he was left to the care of his uncle, Godwin Swift, who put him to school at Kilkenny and afterwards entered him at Trinity College, Dublin. Losing his uncle in 1688, he came to England, and in 1689 was taken up by Sir William Temple, a connection of his mother, who installed him at Moor Park, near Farnham, Surrey, as his secretary. After some years he became dissatisfied with his position, and returned to Dublin, taking orders as priest in 1695, and being presented to the prebend of Kilroot, near Belfast. In the following year he went back to Moor Park as Temple's literary assistant, and the relation continued until 1699, when his patron died, bequeathing him his manuscripts and a legacy of £100. Returning once more to Ireland, he obtained the vicarage of Laracor with the living of Rathbeggan. He had already, while at Moor Park, written *The Tale of a Tub* and *The Battle of the*

Books; he now gave himself up largely to political writing, spending much of his time in London in the company of the leading wits and politicians of the day and forming an intimacy with Harley and Bolingbroke. Throwing his influence more and more on the Tory side, he at last, in 1710, became editor of the *Examiner*. Among his writings in these years were the *Argument to Prove the Inconvenience of Abolishing Christianity* (1708), the *Conduct of the Allies* (1711), and the *Proposal for Correcting, Improving, and Ascertaining the English Tongue* (1712). The reward of his incalculable services to the Tories was long delayed, and when, in 1713, it came, it was not the English bishopric he had expected, but the deanery of St. Patrick's, which he accepted with little satisfaction and less gratitude. Some years later, animated by no sympathy with the country in which he felt himself an exile, he began the publication of a series of tracts exposing the misgovernment of Ireland, the most famous of them being the *Drapier's Letters* (1724). The last of his more notable works and the greatest of all, *Gulliver's Travels*, appeared in 1726, and created an immense sensation. The closing years of his life were years of mental decay. His uncle Godwin had died insane; he had prophesied that, "like that tree," he should "die at the top," and his death, on the 19th of October, 1745, was a long-delayed release from blank imbecility. There is no space here to discuss the problems arising out of Swift's relations with "Stella" and "Vanessa." The former, Miss Esther Johnson, was the daughter of Sir William Temple's steward; at his invitation she, accompanied by a lady companion, followed him to Ireland, living at Trim while he was at Laracor, and at the parsonage while he was in England; and it is probable, though not demonstrable, that in 1716 he privately married her, although he never lived with her or publicly recognised her as his wife. It is certain, however, that in his strange way he was deeply attached to her, and her death in 1728 left him lonely and disconsolate. Why he did not marry her, or, having married her, behaved as though he had not, will never, perhaps, be known; the most charitable and not the least reasonable theory is that he was determined not to transmit to descendants the malady which he felt to be latent in himself. Of "Vanessa," Miss Esther Vanhomrigh, he became tutor in London in 1709, and acquired such influence over her that she made him an offer of marriage, which he evaded rather than refused: and there is too much ground for believing that her death, in 1723, from consumption, was hastened by her discovery or suspicion of his relations with "Stella," and by his cruel resentment of her expostulations.

Swimming, the art or habit and action or practice of moving the body through or on water by unassisted muscular action. Most quadrupeds are instinctively capable of swimming.

Swinburne, ALGERNON CHARLES (b. 1837), poet and dramatist, was born in London and educated at Balliol College, Oxford. His first plays, *The Queen-Mother* and *Rosamond* (1860), attracted little attention, but *Atalanta in Calydon* (1865), a

tragedy on the Greek model, at once established his reputation. *Poems and Ballads*, published in 1866, was followed by the magnificent *Ode on the Proclamation of the French Republic* (1870) and *Songs before Sunrise* (1871), in which he gave free expression to his revolutionary ardour. *Chastelard* (1865), *Bothwell* (1874), and *Mary Stuart* (1881) form a trilogy on the subject of Mary, Queen of Scots, whilst *Erechtheus* (1876) is a drama of the same class as *Atalanta in Calydon*, which in some respects it excels. *The Sisters*, a tragedy, was published in 1892, and *Astrophel* in 1893. In his *Essays and Studies* (collected 1875), his *Studies of Shakespeare* (1880), *Victor Hugo* (1886), and *Ben Jonson* (1889), and various other works, Mr. Swinburne has shown himself a critic of a high order. His lyrical faculty is very remarkable; he combines fiery energy with an inexhaustible flow of language and a keen sense of rhythmical beauty; indeed, it may safely be said that in the mastery of musical sound he is not surpassed by any English poet.

Swine. [PIG.]

Swiss Guards, mercenary troops employed as the bodyguards of the kings of France, of other sovereigns, and still of the Pope. The French Swiss Guards were massacred by the revolutionists in 1789.

Switchback Railway (formerly known as "Montagnes Russes"), a line of rails along which a car or train can move by the action of gravity or momentum over downward and upward gradients in alternation. This contrivance on a small scale forms an amusement at many pleasure resorts. The word "switchback" means in engineering phraseology, "backwards and forwards."

Swithin, or SWITHUN. ST. (d. 862), succeeded Helmstan as Bishop of Winchester in 852. The details of his life are known only from the *Life* ascribed to Gotzelin, a monk of the 11th century. According to this document, he became tutor to Egbert's son, Ethelwulf, and after his consecration as bishop earned the esteem of all by his piety and zeal. The popular tradition regarding the weather following St. Swithin's Day (July 15) is due to the legend that the translation of his body to the cathedral in the 10th century was delayed for 40 days by the rain.

Switzerland is a small country in the centre of Europe, bounded on the west by France, on the north by Baden, on the east by the Austrian empire, and on the south by Italy. It lies between 6° and 10° 30' east longitude, and 45° 50' and 47° 50' north latitude. Its greatest length is about 220 miles, and its greatest breadth 135 miles. Its area is about 15,000 square miles. On the south it is traversed from south-west to north-east by the main chain of the Alps. Parallel to this, and separated from it only by the upper valley of the Rhone, is the range of the Bernese Alps. On the French frontier runs the parallel but much lower range of the Jura. Between the Bernese Alps and the Jura is the plain of Switzerland. The highest summit is Monte Rosa

(15,217 ft.) and the lowest point is the northern end of Lago Maggiore (646 ft.) Switzerland is composed of the upper basins of several important European rivers. On the east and the north it is drained by the Rhine; on the south-west by the Rhone; south of the main chain by the Ticino to the Po; and on the south-east by the Inn to the Danube. The areas of these river-basins in Switzerland are in the proportion of 18, 4, 2, and 1. Switzerland consists of 22 commonwealths (cantons), of which Zug (92 sq. miles) is the least, and Graubünden (2,774 sq. miles) the largest. The cantons Bern, Valais, and Graubünden or Gisons contain between them nearly half of Switzerland. This part of Europe was in the hands of the Romans, who made roads across the Alps and settled several flourishing towns. After the fall of the Roman Empire the region was overrun by the Allemanni on the north, by the Burgundians on the south and west, and by the Ostrogoths on the south-east. Then for several centuries it was under the Frankish kings. When their power declined in the 10th century it fell partly to the Dukes of Swabia and partly to the Kings of Burgundy. In the next century it came under the German emperors, who ruled it by various nobles, to whom privileges were granted which made them absolute masters of the districts which they administered. Some of the towns, Bern, Zürich, Lucerne, early obtained exemption from all save the Imperial authority. At the beginning of the 13th century the cantons of Schwyz, Uri, and Unterwalden were under the Habsburgs, then an unimportant family. But in 1273 Rudolph of Habsburg, who in 1283 had made his son Albert Duke of Austria, and being also bailiff of the three lands, became emperor and king, and these, to defend their liberties, concluded the Eternal League on August 1, 1291. In 1313 the Imperial throne was disputed by Louis of Bavaria and Frederick of Habsburg. The three cantons sided with the former, and Frederick commissioned his brother Leopold to punish them. In the attempt he was completely defeated at Morgarten on November 15th, 1315, and the supremacy of Austria was destroyed. They had still to fear her attacks, and they looked round for help. In 1332 Lucerne joined them; in 1351 Zürich; in 1352 Glarus and Zug, and in 1353 Bern. Thus allied, they were nearly independent, but they were still not united. Thirty years later the four cantons were left alone to meet the attack of the Austrians, whom they completely defeated at Sempach in 1386. The legends of William Tell and Arnold von Winkelried are of late origin, and are now generally discredited. The Swiss defeated the French at St. Jacob in 1444, the Burgundians at Granson and Morat in 1476, and at Nancy in 1477. The fame of the Swiss valour was spread abroad, and their help was eagerly sought by the Great Powers. In 1481 Fribourg and Soleure joined them; in 1501 Basel, Schaffhausen, and Appenzell. In this century conquests were made by the thirteen cantons both to the north and the south. These were administered (and often harshly) by bailiffs appointed by the ruling cantons. This state of things continued till 1798, when the French imposed a new constitution

upon Switzerland, and the subject lands became independent cantons. After various modifications, St. Gall, Grisons, Aargau, Thurgau, Vaud, and Ticino were added in 1803, and Valais, Geneva, and Neuchatel in 1815. Owing to religious differences Basel, Unterwalden, and Appenzell have each been divided into two half-cantons. Christianity was preached in this part of Europe by monks from Ireland in the 6th century, and by the end of the 8th century most of the great monasteries were founded. In the 16th century the Reformation spread to Switzerland, and the differences between Protestants and Catholics led to many disputes and to several civil wars. In 1531 the Catholics were victorious at Kappel, and in 1712 the Protestants at Vilmergen. On both occasions toleration was guaranteed but not observed. The last struggle was in 1847, when the four Forest Cantons, with Zug, Fribourg, and Valais, were defeated by the Protestant cantons. At present the Protestants form about $\frac{3}{5}$, and the Roman Catholics $\frac{2}{5}$, of the population. The government of Switzerland has from the earliest times been republican. In the old cantons all business was transacted by an assembly (*Landesgemeinde*) which met once a year and appointed the president (*Landamman*), council, etc. In several cantons this meeting is still retained. Each canton manages its own internal affairs, but cannot make war or peace, form alliances, fix customs' dues, or coin money. These are in the hands of the Federal Assembly, which is composed of an upper and a lower house. To the former each canton sends two members, and each half-canton one, elected either by the council or by the whole electoral body. To the latter (147 members) every 20,000 inhabitants send a member. The elections are triennial, and the electoral age is 20. The Federal and most of the Cantonal electorates also take a direct share in legislation by the Referendum (*q.v.*) and Initiative (a petition for a specific change in the law, signed by a certain number of electors within a given time, obliging the legislature to take a vote on the desirability of the change, and legislate accordingly). The Federal executive is in the hands of the Federal Council, a committee of seven, elected by the chambers for three years. The population of Switzerland is about 3,000,000. The chief town is Bern (47,151). The most important commercial town is Zürich (91,222). Other important towns are Basel (74,247), Geneva (72,779), Lausanne (34,049), St. Gall (27,824), and Lucerne (20,570). There is no regular army in Switzerland, but every able-bodied man on reaching the age of 20 has to undergo military training, and up to the age of 32 is in the first line (*Auszug-élite*), up to 44 in the second line (*Landwehr*), and up to 50 in the third line (*Landsturm*). The number of these is nearly 500,000, and the annual cost about 1 $\frac{3}{4}$ millions sterling. Switzerland has six universities, largely attended by foreign students, more than 8,000 primary and about 450 secondary schools. The greater part of the population is engaged in agricultural and pastoral pursuits, but there are some flourishing trades, as cotton-spinning, silk-weaving, watch-making, and machine-making. Up to 1830 each canton had a special costume, but

these have since almost disappeared. To the student of history Switzerland is perhaps the most interesting country in Europe.

Ethnology. That Switzerland has been inhabited since the remotest times is evident from the numerous remains of the Stone, Bronze, and Iron ages continually turning up, especially about the sites of the old lake-dwellings. It is no longer possible to determine the affinities of these lacustrine populations, fishers, hunters, and pastors, though the bulk of them appear to have been Celts. At least at the dawn of history, about 100 B.C., the present Switzerland was mainly occupied by Celtic peoples, such as the Helvetii of the southern, central, and north-eastern districts, the Rauraci of the Bernese Jura and left bank of the Rhine as far as Alsace, and the Sequani of the southern Jura. The Genavæ, whose name survives in the city of Geneva, were a branch of the Celtic Allobroges, and the neighbouring Nantuates, Veragri, and Seduni were all either pure or mixed Celts. But the Lepontii, who dwelt about the sources of the Rhone, were Ligurians, while the Rhæti of the eastern districts were supposed to be immigrants from Etruria. Under the Empire all became Romanised, as did also the Burgundian Teutons, who occupied the western parts during the invasions of the barbarians; but the Allemanni, who seized all the northern districts, preserved their Teutonic speech and nationality, and later encroached largely on the Roman domain in the central and eastern cantons. Thus it is that Switzerland still continues to be divided between peoples of German and Latin speech, the former all speaking Allemannic (High German) dialects, the latter various Romance (Neo-Latin) dialects, French and Vaudois in the west, Italian in the south, Ladin or Roumansch in the east. German, dominant in fifteen cantons, is the language of two-thirds of the whole population, 2,083,000 in 1888; French is spoken in five cantons by 635,000; Italian in one (Ticino) by 155,000, and Ladin in one (the Grisons) by over 38,000. Most of the Germans and some of the French are Protestants (1,716,500), the rest Catholics (1,184,000). Amid these profound racial, religious, and linguistic differences the main bond of union is the common sense of nationality and love of freedom, fostered by long-established democratic institutions.

Sword, an offensive weapon for cutting and thrusting, which consists of a metal blade with one edge or two edges and a point, or of a light pointed blade with one cutting edge, and a hilt or handle with a cross-piece or plate (the pommel) and sometimes with a hand-guard. The sword-blade is divided by writers on fencing into three parts—the *forte* (next the hilt), the *middle*, and the *foible*. Swords vary greatly in length, from the short sword of the Romans, which was little more than a dagger, to the heavy two-handed sword or claymore; and they are either straight or curved (such as sabres and scimitars). The thrusting swords without a cutting edge are rapiers and small-swords. The sword is an attribute of justice and of royalty.

Swordfish, any individual of the spiny-finned family Xiphiidæ, from tropical and sub-tropical

seas, and having the upper jaw produced into a stout wedge-shaped weapon. The best known is the Common Swordfish (*Xiphias gladius*), common in the Mediterranean, the warmer parts of the Atlantic and the Pacific, some straying to Britain. Swordfishes feed on herrings, mackerel, and cuttlefishes. The young forms differ greatly from the adult fish. [SAWFISH.]

Sybaris, a Greek town of Lower Italy, was in Lucania, on the Gulf of Tarentum, and is supposed to have been colonised by Achæans and Troezenians in 720 B.C. The inhabitants became a byword for their luxury and effeminacy, and, when attacked by a much smaller number of Crotonians, were unable to hold their own. The men of Crotona turned the river through Sybaris, completely destroying it, and the inhabitants were scattered among the neighbouring cities.

Sycamore, a name originally belonging to a wild fig (*Ficus Sycomorus*), but now transferred to the Great Maple (*Acer Pseudo-platanus*), which is known in the south of Scotland as the Plane. It is a native of Central Europe, introduced into England, where it sows itself freely, in the 14th century. It forms a tree sometimes 60 feet high, with smooth, deciduous bark; pairs of large, dull-green, palmately five-lobed leaves, glaucous on their under surfaces; pendulous racemes of green, polygamous flowers; and double samaras with scimitar-shaped wings. The wood is white, and is largely used in turnery, for bread-platters, etc., and for toys. It is a valuable fuel, and makes excellent charcoal. Sugar can be prepared from the spring sap, and the tree is often very valuable for its shade.

Sycosis. [RINGWORM.]

Sydenham, a suburb of London, about 6 miles S.S.E. It is well known on account of the Crystal Palace upon Sydenham Hill, which was erected in 1854 from the materials of the Exhibition held in Hyde Park in 1851. The Palace commands a good view, and is itself a landmark for miles in every direction. The multiplication of amusements in London itself has caused the Palace to be less resorted to than formerly, but the fireworks in summer are immensely popular.

Sydenham, FLOYER (1710-87), an eminent Greek scholar, educated at Wadham College, Oxford. His chief work was his translation of Plato's *Dialogues*, with introductions and notes. Unable to pay a small debt, he was thrown into prison, where he died. The sympathy excited by his fate resulted in the formation of the Literary Fund.

Sydenham, THOMAS (1624-89), "The English Hippocrates," was born in Dorsetshire and educated at Oxford, where he became a fellow of All Souls'. Before 1663 he had settled in London as a medical practitioner. Abandoning the "chemical" and "mathematical" theories of his day, he made it his object to study the symptoms and constitution of each patient who came under his care, and be guided by his own observation and experience. He was consequently regarded with but small favour by the College of Physicians, but his treatment

was uniformly successful, and he enjoyed the esteem of Locke, Boyle, and other eminent men.

Sydney, the oldest city in Australia and the capital of New South Wales, is situated on Port Jackson, lat. 33° 51' S. and long. 151° 11' E. It was founded in 1788 and named after Viscount Sydney. Port Jackson forms a magnificent harbour, and the traffic from Sydney to all parts of the world is very considerable. The University is open to both sexes, and among other fine buildings may be mentioned the Catholic cathedral, the museum, the Town Hall, and the Post Office. The climate of Sydney is healthy and temperate.

Syenite, a name formerly applied in England to that hornblendic variety of granite which occurs at Assouan, the ancient Syene, where Cleopatra's Needle and the sister obelisks were quarried. It is now applied to a plutonic, distinctly crystalline rock, composed chiefly of flesh-coloured orthoclase and black hornblende, but containing some plagioclase and some quartz, occurring typically in the Plauenscher-Grund of Dresden. Syenite contains about 60 per cent. of silica, and has a specific gravity of from 2.75 to 2.9; so that it is an *intermediate* rock.

Syllogism, in logic, is, according to Whately, an argument expressed in strict logical form, so that its conclusiveness is manifest from the structure of the expression alone.

Sylph, in the system of Paracelsus, a spirit of the air. Sylphs are of the male sex, and resemble men in appearance, and in all other respects, except that they possess no soul. It was considered possible that they should intermarry with the daughters of men, and the offspring of such unions belonged to the mother's race, not to the father's. Pope introduced sylphs into his *Rape of the Lock*, and probably brought the term into general use, though it is now usually applied to a graceful girl or young woman.

Sylviculture, that division of the science of forestry which relates to the planting and cultivation of collective bodies of forest-trees. Its first fundamental principle is that the natural productive capacity of the soil must be carefully conserved, in order that it may satisfy continuously and uninterruptedly all rational demands made on the land with regard to the production of timber, or of other forest crops. Its second principle is to select for planting the trees most suitable to the climate, soil and situation to be planted, due regard being paid to the commercial value of the produce. The application of the principles of meteorology, geology, and vegetable physiology to the problems of nutrition, growth and reproduction in trees belongs thus both to arboriculture (q.v.), the study of trees individually, and to sylviculture. So, too, the protection of whole woodlands from injurious climatic influences, insects, fungi, etc., belongs to sylviculture, as the treatment of the individual tree in such matters does to arboriculture. Sylviculture is not directly concerned with the sale of forest produce; but it is most pressingly interested in the truly economical management

and realisation of this produce. A third leading principle may be said to be that the annual felling of mature timber should not exceed the annual production of the forest. To cut less is to neglect economy of management: to cut more is to trench upon the capital of the forest. This involves the use of a proper *working-plan*, and systematic forest book-keeping. Among the most important practical results of the long and careful study of silviculture in Germany is the conclusion that *mixed forest*—i.e. the cultivation of several species together—is preferable to *pure forest*, or the growth of species singly, and the principle that trees should be planted and thinned in such a manner as to maintain *close canopy*, or unbroken shade beneath them.

Symbiosis, a term originally employed by De Bary in 1879, for cases in which organisms of distinct species live together in such a condition of consortism or commensalism as to benefit both, in opposition to parasitism (q.v.), in which the advantage is all on one side. Etymologically, however, and perhaps as a matter of convenience, it might be well to expand the connotation of the term to include all forms of organic association—e.g. *socialism*, or the association of numerous individuals of one species, *mutualism* and *parasitism*, especially as the two last-named seem connected by numerous intermediate cases. The two most striking instances of mutualist symbiosis are the alga-fungus association first pointed out by Schwendener in 1868 in the cases of lichens (q.v.), and the algal *yellow-cells* within the bodies of Radiolaria detected by Haeckel in 1870, and explained by Geddes in 1882. It is important to notice in the former case that the mutualist community of alga and fungus constituting the lichen can live in situations where neither can exist separately. In the latter case Geddes showed that the yellow cells had cellulose walls, were coloured by diatomins, evolved oxygen and formed starch when in sunlight, and absorbed carbon-dioxide and nitrogenous waste substances from the animal's body, thus performing both respiratory and quasi-renal functions for it and being nourished in return. He concludes "for a vegetable cell no more ideal existence can be imagined than that within the body of an animal cell of sufficient active vitality to manure it with abundance of carbonic anhydride and nitrogenous waste, yet of sufficient transparency to allow the free entrance of the necessary light. And, conversely, for an animal cell there can be no more ideal existence than to contain a sufficient number of vegetable cells, constantly removing its waste products, supplying it with oxygen and starch, and being digestible after death."

Symmetry. Two objects which are related to each other, as the right hand is to the left, are said to be symmetrical. The one is, in fact, the image of the other. In the case of the two hands the symmetry is, of course, not faultless; but we can take any object we like and place it in front of a plane mirror, and we shall see behind the mirror an object exactly the reverse of the real one in front. Every point or line in the object has its

representative in the image, and the two corresponding details are at the same distance from the reflecting surface. This surface is therefore a *plane of symmetry*. In considering a cube carefully we notice that there are several methods of dividing it into two symmetrical parts. There are, in fact, nine such methods, and the dividing planes are the nine planes of symmetry possessed by a cube. An octahedron, however, has the same number of planes of symmetry, while a hexagonal prism has seven. In no science, perhaps, does symmetry play so important a part as in that branch of mineralogy known as crystallography. Crystals are divided into families, according as they possess this characteristic in a greater or less degree. [CRYSTALLOGRAPHY.] A sphere is a solid possessing an infinite number of planes of symmetry. Any plane passing through its centre divides it into two exactly equal and similar parts. If we are dealing with plane figures, the circle possesses greatest symmetry. Any diameter is an *axis of symmetry* dividing the circle into two halves, of which each is the image of the other. An ordinary isosceles triangle has one axis of symmetry—the line through the apex bisecting the base. This is multiplied by three when the isosceles is specialised into an equilateral triangle.

Symonds, JOHN ADDINGTON (1840–93), man of letters, was born at Bristol, and educated at Harrow and Balliol College, Oxford. His *Renaissance in Italy* (7 volumes, 1875–86) is a monument of profound knowledge and literary insight. He also published *Studies of the Greek Poets* (1875–76), *Shakespeare's Predecessors in the English Drama* (1884), *Shelley and Sidney in the English Mon of Letters* series, and other works.

Symphony, a musical composition in three or more movements for an orchestra. This most classical form of instrumental music was first developed by Haydn, and has been carried further by Mozart, Beethoven, Schumann, Brahms, and many other masters. In form the symphony is based on the sonata (q.v.).

Sympodium, a type of branching in which at each bifurcation one branch develops more vigorously than the other, so that the successive strong-growing branches form a *pseud-axis*, on which the weaker branches appear to be lateral outgrowths. Sympodia are of four kinds:

- I. In one plane, forming a bilateral system.
 - A. The *Rhipidium* or fan, with the branches alternately in opposite directions.
 - B. The *Drepanium* or sickle, with the branches all to one side.
- II. In different planes, forming a radial system.
 - C. The *Cicinnus*, with the branches alternately in opposite directions.
 - D. The *Bostryx*, with the branches all to one side.

Synagogue, the place of meeting of a Jewish congregation for worship and instruction, under the control of a board of elders, whose president is the "ruler of the synagogue." The term (Greek, *synagōgē*, "a bringing together") was primarily applied to the congregation and its meetings.

Syncarpous, having several carpels united together. The union may vary in extent, from the slight union of the lower halves of the ovarian regions of the two carpels in the saxifrage, to the complete fusion in the ovarian, styler, and stigmatic region in the Primulaceæ. Very often the number of the carpels remains apparent, either in external lobing of the ovary, as in the lily; or in the number of chambers or of placentas, as in St. John's wort and violet respectively; or in distinct styles, as in grasses; or in stigmatic lobes, as in Compositæ. The great majority of angiosperms have syncarpous gynæcia.

Synclinal, or trough, a downward fold in a series of strata, or, technically, when two portions of one or more strata are so folded as to dip from opposite directions towards a central depressed axis. This axis will necessarily be the line of strike. Owing to the compression along this line on the upper surface of beds thus folded, the synclinal is a durable form, resisting denudation; and many mountains and hills, such as Snowdon, have this structure. All our coal-fields are preserved in synclinal folds, and they are essential in the formation of artesian wells (q.v.).

Syncope. [FAINTING.]

Synergidæ, in botany, the two cells situated at the apex of the embryo-sac.

Synesius (*circa* 375-414), a native of Cyrene, became a disciple of Hypatia (q.v.) at Alexandria, and continued to hold Neoplatonic views almost to the close of his life. In 411 he was consecrated Bishop of Ptolemais in spite of his own scruples respecting his orthodoxy. His works include an oration *De Regno* (delivered during an embassy to Arcadius at Constantinople in 399), a treatise, *De Providentia*, letters, and some remarkable *Hymns*.

Synodic Period. [PLANET.]

Synovial Sac. [JOINT.]

Syntonin is an albuminoid or proteid material, formed by the action of dilute acids upon many other proteids. It is a white solid, insoluble in water, but may be dissolved by acids or alkaline liquids.

Syphilis, a contagious disorder transmitted by direct inoculation, which presents in many respects resemblances to the "exanthemata," but differs from this group of maladies in its long period of latency, in the length of time during which the early specific eruptions may appear, and in the extended period throughout which the later manifestations of the disease may be developed. The first indication of the disease is the occurrence, usually about four weeks after inoculation of the contagion, of a small papule, which gradually extends, with induration of the surrounding skin, until it attains its full development at the end of about six weeks. This is the hard or Hunterian chancre. Shortly after its appearance the neighbouring lymphatic glands—that is to say, usually those of the groin—become enlarged and indurated. These phenomena constitute what are known as the *primary symptoms* of the disease. After the

lapse of about two months from the time of inoculation, the *secondary symptoms* appear. These consist of febrile disturbance, cutaneous eruptions of variable character, and affection of the mucous membrane of the throat; what are known as mucous tubercles are sometimes developed, and occasionally joint affections, periostitis, iritis and other eye troubles appear. Still later, and usually after the lapse of about a year, but it may be after a much longer interval of time, *tertiary symptoms* are apt to occur. These may involve the skin (producing tubercular or scaly eruptions) or the mucous membranes (whether of the throat, tongue, larynx, or other parts), or may involve the muscles, bones, or viscera (including among the latter the brain and other nervous structures). These tertiary phenomena are usually attended by a peculiar overgrowth of tissue, resulting in the formation of what are known as gummata. Tertiary lesions are generally distributed unsymmetrically, and have a marked tendency to recur. Syphilis is a common cause of abortion and still-birth, and the children of syphilitic parents sometimes present certain characteristic symptoms which constitute the phenomena of the disease known as "inherited syphilis." These consist mainly of "snuffles," skin eruptions, and the development of mucous tubercles in infant life, while later characteristic phenomena are flattening of the bridge of the nose, a peculiar malformation of the permanent incisor teeth, and interstitial keratitis. The treatment of syphilis mainly consists in the administration of mercury, the "mercurial course" being continued with careful regulation over a considerable period of time; and in the treatment of the later phenomena iodide of potassium has been largely employed.

Syracuse, now SIRACUSA, was the chief city of ancient Sicily. It was surrounded by a wall of 22 miles, was divided into five parts, and possessed two harbours. Founded by a Corinthian colony in 734 B.C., it became rich and prosperous, and possessed a larger population than Athens. The Athenians besieged it in vain in 414 B.C., after a prolonged assault, and it underwent a siege at the hands of the Romans 215-212 B.C., falling in the last of these years, in spite of the efforts of the engineer, Archimedes, who was a native. Its early constitution was republican, becoming then oligarchical, and at times it was ruled by absolute kings. Theocritus was a native. The present town, occupying only the peninsula of Ortygia (the original site of the old city), has a good harbour, deep and large, is fortified, has good streets, lighted by electricity, and a cathedral, which was formerly a temple. Among the relics of the old city are a large amphitheatre, the extensive catacombs, and the Ear of Dionysius, which forms a cavern 170 feet long, 35 wide, and 60 high, and possesses a wonderful echo.

Syria, in Asiatic Turkey, extends along the E. coast of the Mediterranean from the Taurus range on the N. to Egypt and Arabia on the S., and has the Euphrates and the Syrian desert on the E. On the coast are some low sandy tracts, but it is generally precipitous, rising in Mount Carmel to

3,000 feet. [The portion of country between Libanus and the Sinai Peninsula is described under the word PALESTINE.] The peak of Jebel-el-Sheik in Anti-Libanus, 30 miles W. of Damaseus, is ten or twelve thousand feet high, and forms a landmark through a wide stretch of country. The principal rivers are the Euphrates and Jordan, and the rivers that water Damascus. The valley between Libanus and Anti-Libanus was called Cœle (hollow) Syria. The climate of the mountains is good, but the coast is unhealthy. The valleys of Libanus are very fertile, and produce corn, cotton, fruit, indigo, grapes, sugar canes, mulberries, olives, tobacco, and there are large forests. Game is plentiful, and domestic animals are the camel, ox, goat, sheep, mule, ass, horse. The bee is largely cultivated. Iron and some coal have been found, but exploration has not gone far. Trade is in a languishing state, though Damaseus still manufactures silk and swords, and some silk is made at Aleppo and Beyrout. The last of these towns is the only port of any commercial consequence. The inhabitants number almost 3,000,000, and consist of Syrians, Arabs, Turks, Greeks, and Jews, besides nomad Turkomans, Kurds, and Bedouins. The mountaineers are Druses and the Christian Maronites. Their quarrels led to the intervention of the Western Powers in 1861. Syria has belonged successively to Assyria, Persia, Greece, Rome, the Byzantine Empire, the Arabs, and the Turks, and was from 1833-40 in the hands of Mehemet Ali.

Syrian Bear (*Ursus syriacus*), a light-coloured form of the Brown Bear (q.v.), from Western Asia (2 Kings ii. 23).

Syringe is an extremely simple form of pump (q.v.). It consists of a cylinder ending in a nozzle, and containing an air-tight piston. If the nozzle be placed in some liquid and the piston be pulled outwards, liquid is forced into the cylinder by atmospheric pressure. On removing the syringe and pushing the piston inwards the liquid is forced out from the nozzle.

Syzygy is the conjunction of earth, sun, and moon; hence the moon is said to be in syzygy when new or full.

Szechwan is a large province in West China, and contains 185,000 square miles. It has Tibet to the N.W. and Yunnan to S.W., and is watered by the Yang-tse-Kiang and its tributaries. The province is generally hilly, and in the W. mountainous. Coal and iron are both found. The exports, consisting of opium, silk, salt, sugar, tobacco, hides, musk, white wax, amount to £5,000,000; and the imports, chiefly cottons and woollens, to £3,000,000. Chung-tu is the capital, but Chung-king the chief commercial town. This was opened to British trade in 1889.

Szegedin is a town of Hungary, on the right bank of the Theiss. 60 miles W. of Arad. It consists of the town proper, almost destroyed by flood in 1879; the fortress, approached by two bridges, having walls, ditches, and a garrison, a church and prison; the upper suburb, containing a church

and a salt magazine; the lower suburb, containing a Franciscan monastery, church, and hospital; and the corn market, where are the town house, barracks, cloth and tobacco factories, etc. Some barge-building is carried on, and the chief productions are tobacco, salt, wood, wool, cotton, corn, and cattle.

T.

T, the twentieth letter of our alphabet, is derived from the Greek *tau*, which was in all respects equivalent to the Semitic letter of the same name. It is the hard or voiceless dental mute (whereas *ð* is soft or voiced), and is produced by the contact of the tip of the tongue with the teeth (as in French), or the gum behind the teeth (as in English), or the tip of the tongue may be bent back against the palate, in which case the sound is called "cerebral."

Tabasheer, or TABACHIR, the Indian name for the remarkable siliceous secretion formed in the joints of old bamboo stems. It is an amorphous hydrated silica or opal; but is supposed in India to possess medicinal virtues. It is of a bluish-white colour, and has a pearly lustre.

Tabes Dorsalis. [LOCOMOTOR ATAXIA.]

Tabes Mesenterica, a term sometimes applied to a wasting disease usually affecting children, and associated with tubercular deposit in the mesenteric glands. [MESENTERY.]

Tabriz, a town of Persia, upon the river Aji, which flows into Lake Urumiah, 40 miles E. of the town, and capital of the province of Azerbaijan. There is an extensive citadel of brick, which shows marks of earthquakes. Tabriz has still a considerable transit trade, though its importance in this respect has been diminished by the construction of Russian railways. The line of Anglo-Indian telegraph passes through the town. The ruins of the Blue Mosque (1450) are partly ornamented with blue tiles in arabesque. The chief industries are in leather and silk, and the gold and silver work of the town is of great excellence. The imports and exports are great, the former consisting mostly of cotton and woollen goods, wine, spirits, and sugar; and the latter of raw silk, carpets, shawls, drugs, spices, and dried fruits; and there is a good deal of smuggling. The town (anciently *Tauris*) was in 297 A.D. the capital of Tiridates II., King of Armenia, and was enlarged in 791 A.D. by the wife of the Caliph Haroun Alrashid. It has often been besieged, and has suffered much from earthquakes.

Tabulæ. [TABULATA.]

Tabulata, a term once used as name for a group of corals characterised by the fact that the body chambers or "loculi" are crossed by horizontal plates known as tabulæ. These are most common in the corals of the Palæozoic rocks. It is now, however, known that these tabulæ are merely

supporting structures developed quite independently in different groups of corals in which the soft parts of the animal require some support below. The old group of Tabulata is therefore split up. Some, such as the living Blue Coral, or *Heliopora*, and *Halysites*, or the Chain Coral, are assigned to the Alcyonaria; others, such as the fossil *Halysites*, to the Perforata (q.v.), while the majority, including the Cyathophylloidea, Zaphrentoidea, and Cystophylloidea, go to the Aporosa.

Tacamahac, an oleo-resin, fragrant in smell, employed in ointments for ulcers, and secreted by various trees. East Indian tacamahac, the product of *Calophyllum Inophyllum* and *C. Calaba*, is yellowish and acidulous, and has a lavender-like smell. Brazilian tacamahac is the product of *Icica Tacamahaca* and *Elaphrium tomentosum*, and is light-brown, opaque, and bitter. In Canada and the Northern United States the name is applied to the balsam exuded from the buds of the balsam-poplar (*Populus balsamifera*), formerly imported into Europe as "baume focot."

Tacitus, CAIUS CORNELIUS (b. circa 54 A.D.), an eminent Roman historian. The details of his life must be gathered mainly from allusions in his own works and the letters of Pliny the Younger. He is supposed to have been the son of Cornelius Tacitus, procurator of Gallia Belgica, who belonged to a family of equestrian rank. Whilst still young he acquired celebrity by his eloquence as a pleader. In 78 he married the daughter of Cnæus Julius Agricola, who was about to begin his brilliant career in Britain. Appointed quæstor by Vespasian in 79, the historian passed through the office of ædile or tribune to that of prætor (88) under Domitian, and in 97, during the reign of Nerva, was made consul suffectus. Two years later he and Pliny were engaged in the prosecution of the infamous Marius Priscus, who had been proconsul of Africa. This is the last event in his life of which we have any record. The surviving works of Tacitus are a dialogue, *De Oratoribus*; a life of his father-in-law, Agricola (an extremely picturesque and interesting piece of biography); a treatise, *De Situ Moribus et Populis Germaniæ* (our earliest source of information concerning our own ancestors and the races nearest akin to them); and two historical works of the first importance—the *Historiæ*, extending from A.D. 68 to 96 (of which we possess four books and part of a fifth), and the *Annales*, from 14 to 68 (comprising sixteen books, of which eight are still complete, and fragments of four others remain). The two latter works, which give a terrible picture of the decay of imperial Rome, are marked by the utmost compression, abruptness, and vigour of style; but at the same time the language is ornate, and noble sentiments find their just expression in eloquent and sonorous periods. The occasional obscurity is probably intentional, the author's design being to attack the vice and political corruption of the time without endangering his own liberty or life. His fairness, however, has been much disputed, especially with reference to the treatment of Tiberius in the *Annals*.

Tacoma, a considerable port in the state of Washington, U.S.A., is situate upon the E. side of Puget Sound, and has developed during the last few years from a small village to its present importance. It lies to the W. of the northern range of the Cascade Mountains, which here rise to a height of 14,000 feet, and is 145 miles N. of Portland (Oregon). It is well served by railways, and has a large trade in tea with Japan, as well as in coal, iron, and lumber. The chief productions are wheat, hops, fruit, and vegetables. In the neighbourhood are forests, and there are many Indians.

Tactics, the movements and disposition of troops adopted by contending forces when they are face to face and desire to gain some immediate advantage. The sphere of tactics must not be confused with that of strategy, which is concerned with the general conduct of a campaign rather than with its details at any one time or spot. A distinction is made between various kinds of tactics, according to the character and extent of the operations, the troops employed, and other circumstances. Thus *grand tactics* and *manœuvre tactics* deal with those comprehensive movements on which hangs the fate of great battles, whilst *minor tactics* relate to outposts, reconnaissance, the action of advanced and rear guards, and other operations on a small scale. So again there are *tactics of cavalry*, *infantry*, and *artillery*, *combined tactics*, *siege tactics*, and *mining tactics*. In naval, as in military, warfare there is a broad distinction between tactics and strategy. Naval tactics are concerned with the management of ships and fleets during an action, whereas the aim of naval strategy is to obtain and keep the command of the sea. The battle of Salamis (q.v.) is an ancient example of the skilful employment of tactics according to recognised rules. At an early date it had become an accepted principle that force should be concentrated against some point of the enemy's fleet, which would then serve as a "basis of operations." The advantage of obtaining the weather-gage, so as to facilitate the boarding of the enemy's ships, was also fully appreciated. But the modern "line-of-battle" dates only from the war between England and Holland during the Commonwealth and the reign of Charles II., when it was introduced into both navies. It is said that the original purpose of the line-of-battle composed of ships drawn up either abreast or one behind another, so as to afford mutual assistance at the shortest notice, was to avert the havoc wrought by fire-ships. The manœuvre of breaking the enemy's line by cutting through it was carried out with the utmost skill by Rodney in 1782. In several of Nelson's great battles, notably in that of Trafalgar, he showed himself an unrivalled master of tactical resource. Since his day the circumstances attending naval actions have been much changed through the introduction of steam and armour-plating, and it is impossible to say what manœuvres would now be employed in a battle between ironclads.

Tadpole, the larva of the frog (q.v.). Used also of other amphibian and of Ascidian larvæ.

Tænia. [TAPEWORM.]

Tagala, the most important, though not the most numerous, of all the peoples of the Philippine Archipelago, whose original home appears to be the valley of the Pasig ("River of Manilla"), whence they spread in remote times to all the central parts of the great island of Luzon, and later to Mindoro and most of the neighbouring insular groups. In 1893 the Tagala nation numbered altogether 1,500,000, and the Tagalog language is steadily encroaching on all the surrounding idioms. It is a highly-developed member of the Malayo-Polynesian linguistic family, cultivated by the missionaries and written with a peculiar alphabet derived, like so many others in Malaysia, from an Indian (Devanagari) prototype. The Tagalas themselves are certainly of Malay origin, though greatly mixed in some districts both with Chinese and European (Spanish) elements, and consequently presenting a great variety of physical features. But the average type is distinguished by a yellowish-brown complexion, round head, somewhat crushed nose with wide nostrils, rather thick lips, prominent cheek-bones, low brow, large black eyes, abundant coarse black hair, and divergent great toe, giving great pliancy to the feet, which are largely used, like the hands, for prehensile purposes. The national name (*Ta-Gala*) means "Water-People," and the Tagalas still cling to the river-banks, plains, and coast-lands, avoiding the surrounding uplands, and dwelling reluctantly in the large *pueblos* and *barrios*, in which many have been forcibly settled by their Spanish rulers. Such is the fertility of the soil that, despite the national indolence and rude methods of cultivation, they raise heavy crops, especially of rice (the staple food), tobacco, cotton, indigo, maize, cacao, and abaca (Manilla hemp). At the arrival of the Spaniards Islam had already made some progress amongst the coast tribes, but the great bulk of the people were still pagans. Since then all have become nominal Roman Catholics, and, instruction being obligatory, large numbers possess some degree of education; but many of the old practices survive, and the moral standard is admittedly low. The tendency to relapse into the ancestral savagery is strong, as shown by the numerous class of *remontados*, or outcasts, who take refuge in the woods, band together as brigands, plunder the settled districts, and at times even attack the suburbs of Manilla. (Blumentritt, Bastian, Meyer, Pardo de Tavera.)

Tagus, the largest river of the Spanish peninsula, rises in the mountainous country between the provinces of Guadalajara and Teruel, and flows first north-west, then south-west past Aranjuez, then with a generally west course past Toledo and Alcantara, and, entering Portugal, turns south-west at Abrantes, and passing by Santarem opens out into the Bay of Lisbon, passing due west to the south of Lisbon, entering the Atlantic ten miles below the city at Entrada do Tejo, after a course of 566 miles. It is navigable for steamers to Santarem, and for small vessels to Abrantes. Most of its tributaries are on the left bank.

Tahiti, the chief of the Society Islands, is in the South Pacific Ocean, 2,000 miles N.E. of New Zealand, and 3,400 S.W. of San Francisco. The whole group extends 200 miles N.W. and S.E., and Tahiti itself contains 600 square miles. Many of the islands are mere atolls, and half of them uninhabited. The formation is volcanic, and behind the fertile shores rise well-wooded mountains, to a height of 7,300 feet in Mount Owhena. On the coast are coral reefs, inside of which are some good harbours. The temperature is moist and hot, but healthy, and the climate fine. Mother-of-pearl, cocoa-nut fibre, and trepang are objects of commerce, other productions being oranges, vanilla, fruit, cotton and sugar; and the exports are considerably in excess of the imports. The sweet potato, bread-fruit, and yam are largely cultivated; and the people, who are of the usual South Sea type, have reached a fair degree of civilisation. Captain Cook discovered the group, naming it in honour of the Royal Society. Tahiti is now a French possession.

Tai (T'HAI), *i.e.* "Free," "Noble," most general collective name of a widespread Indo-Chinese race, who were formerly dominant throughout the southern half of China, and who still occupy large tracts in Yunnan together with nearly the whole of Farther India between Burma in the west and Tonking, Annam, and Camboja in the east. The peoples of Tai speech number altogether over thirty millions, the chief divisions being the Shans of Yunnan, the Ngïou or Shans of the border-lands between Burma, Yunnan, and Siam, the Lao of North and East Siam, the Siamese proper, the Ahoms of Assam, and the Khamti of the Upper Irawadi basin. The Shans and the Lao are essentially the same people, and they differ from the Siamese only in their somewhat ruder culture, more vigorous constitution, and more energetic character. All alike are Tai, or T'hai, as the Siamese pronounce the word with an aspirate, all are of Mongoloid stock, all are Buddhists, and all speak slightly divergent dialects of the same Indo-Chinese language, which, before the arrival of the Bak tribes (Chinese proper), was the current speech throughout the whole region between the Yang-tse-Kiang and the Gulf of Siam. The fundamental unity of the race is recognised by the various branches, who appear to regard the *T'hai-niai* or "Great T'hai" of the province of Xieng-Mai as the oldest member of the family. Despite their political ascendancy, the Siamese are only *T'hai-noi*, or "Little T'hai," while the other great branches are named either from their relative position to the *T'hai-niai*, or from their respective provinces. Thus, those of Yunnan are *T'hai-neua*, "Upper Tai," and *Tai-Lem*, *Tai-La*, *etc.*, are simply the Shans of the provinces of Lem, La, *etc.* The substantial unity of the Tai race is a great ethnological fact, which has now been thoroughly established, although not yet recognised by European politicians in their dealings with the indigenous populations of Indo-China. [LAO, SIAMESE.]

Tailor Bird (*Orthotomus sutorius*), a warbler from the Oriental region, deriving its name from

the fact that it stitches two or three leaves together to form a cup-like support for its nest.

Taine, HIPPOLYTE ADOLPHE (b. 1828), French historian and critic, was born at Vouziers in Ardennes, and educated at Paris in the Collège Bourbon and the École Normale. In 1864 he became professor at the School of Fine Arts in Paris. His chief work is *Les Origines de la France Contemporaine* (1875-90), in which he attacks the Revolution. The *Histoire de la Littérature Anglaise* is a remarkable example of the attempt to apply the inductive method to literary studies.

Tâi-Pings, the name by which the followers of the Chinese rebel leader Hung Hsiû-chwan (1813-64) are known to the outside world. Tâi-Ping (Grand Peace) was really the name of the dynasty of which Hung was to be the founder. He was born in the province of Canton, and in early life acquired some perverted notions of Christianity, which worked strangely in his mind. Believing he was summoned by a divine call to overthrow the Manchû dynasty and establish a new religious and political era, he proceeded, in concert with two friends who shared his views, to organise an insurrection, which broke out in 1851 in the province of Kwang-si. It gradually extended northwards, and in March, 1853, the rebels appeared before the gates of Nanking. From this city, which was soon taken, a large body was sent against Peking. It advanced nearly to Tien-tsin, but did not venture to attack the capital. In 1855 the insurgents began to lose ground, owing to the decline of religious enthusiasm and the rivalry of Hung's subordinate "kings." The emperor was aided by a body of foreigners led by an American, General Ward, and after his death in 1862 a British contingent was raised in Shanghai, the command being now taken by Colonel Charles Gordon (q.v.). The rebels were speedily dispersed, Nanking falling in July, 1864. Hung is said to have taken poison.

Tait, ARCHIBALD CAMPBELL (1811-82), Archbishop of Canterbury, was born at Edinburgh and studied at the universities of Glasgow and Oxford. He opposed the Oxford Movement, and was one of the "Four Tutors" who protested publicly against the construction put upon the Articles in *Traet XC*. He was headmaster of Rugby 1842-49, Dean of Carlisle 1849-56, and Bishop of London from 1856 to 1868, when he was made Archbishop of Canterbury. Dr. Tait was a hardworking prelate, and he had a strong leaning to compromise.

Tait, PETER GUTHRIE (b. 1831), man of science, was born at Dalkeith, and educated at the universities of Edinburgh and Cambridge. His contributions to mathematics and physical science include works on *Quaternions* (1866), *Thermodynamics* (1868), *Heat and Light* (1884), a *Treatise on Natural Philosophy*, written in conjunction with Lord Kelvin (1867), and many learned papers in scientific periodicals. *The Unseen Universe* (1874) and *Paradoxical Philosophy* (1878), by Tait and Balfour Stewart, discuss the relations of science and religion.

Tajik (TAJAK, TAUSIK), a term of doubtful origin, dating from the Sassanian epoch of Persia, and in the Pahlavi writings used at first to indicate the Arabs in general, and then their descendants born in Persia or elsewhere out of Arabia. Later, when the distinction was weakened between Arab and Persian Mohammedans, Tajik became the collective name of the latter as well, and according to present usage it applies specially to all communities of Persian stock and speech wherever found in Central Asia. These are co-extensive with the former limits of the Persian Empire, and are found even in Chinese Turkestan beyond those limits. But since the ascendancy of the Turki peoples the Tajiks have become the subject element almost everywhere, except in Darwaz, Wakhan, and Badakhshan. In all these regions the Tajiks are essentially the settled or peasant class in the rural districts, the traders and artisans in the towns, and Persian (or some variety of it) is everywhere their mother-tongue. Hence the terms *Pârsivân*, *Dehqan*, *Sart*, etc., i.e. "Peoples of Persian speech," "villagers," "traders," etc., currently applied to them by their Turki, Afghan, or Baluchi neighbours. All are Mohammedans of the Sunni sect, although their kinsfolk of Persia are mostly of the Shiah sect. The original Iranian type has been modified in diverse ways by long contact with the surrounding Turki, Mongol, and other races, and much miscegenation has undoubtedly taken place, and is still going on, the tendency being towards a general fusion of all the heterogeneous elements in a new homogeneous race throughout Central Asia. The Tajiks are the *Ta-Shiik* (old sound, *Da-Zhik*) of the Chinese records. They are numerous, almost everywhere greatly outnumbering the nomad Mongolo-Tatar populations.

Talbot, an ancient English family, descended from John de Talbot, whose name occurs in Domesday. JOHN TALBOT, the sixth baron, was created Earl of Shrewsbury for his services against France in the reign of Henry VI. He was slain in an heroic attempt to recover Guienne (1453). CHARLES, twelfth Earl, an active politician in the reigns of William III., Anne, and George I., received the title of duke, which lapsed on his death (1718) without male descendants. In 1856 the elder male line failed, the earldom passing after litigation to the third Earl Talbot.

Talbot, WILLIAM HENRY FOX (1800-77), was born near Chippenham, and educated at Harrow and Cambridge. He discovered, independently of Daguerre, the art of fixing images formed in the *camera lucida*. The process is described in his *Pencil of Nature* (1844).

Talc, an Arabic name applied properly to a hydrated magnesium silicate, usually found in a massive or foliated, non-crystalline form. The folia are flexible, but not elastic, thus differing from those of mica, with which talc is popularly confused. Talc does, however, rarely occur in crystals belonging to the Prismatic system. It is white or greenish, translucent, pearly, sectile, and greasy. Its hardness is 1 to 1.5, and its specific

gravity 2.5 to 2.8. It is not decomposed by acids, and before the blowpipe becomes opaque and exfoliates. Steatite, soapstone, and French chalk are merely amorphous unfoliated varieties. Talc is undoubtedly a decomposition-product of various anhydrous magnesium silicates.

Talegalla. [BRUSH-TURKEY, MOUND-BIRDS.]

Talent, the heaviest money-weight used by the ancient Greeks. Three silver talents appear in the course of Greek history—the Æginetan, the Euboic, and the Attic, weighing $83\frac{4}{7}$ lb., $55\frac{5}{7}$ lb., and $57\frac{6}{7}$ lb. respectively, and equivalent to £303 $\frac{1}{8}$, £203 $\frac{1}{8}$, and £210 $\frac{1}{8}$ of our money. Each talent contained 60 minæ.

Talisman, a protective charm, differing from an amulet in that it was supposed to derive its efficacy from its being prepared under the influence of the heavenly bodies. It frequently consisted of the figure or character of one or more of the heavenly bodies, engraved on a stone or metal believed to be influenced by them. The distinction is not always observed, and the terms *talisman* and *amulet* are often used as if synonymous.

Tallemant des Réaux, GÉDÉON (*circa* 1619–1700), French writer, born at La Rochelle, settled in early life on the estate of Des Réaux in Touraine. His *Historiettes*, written between 1657 and 1659, throw much light on the state of society and characters of the leading actors in contemporary history; they were first published in 1834.

Talleyrand-Périgord, CHARLES MAURICE DE, PRINCE OF BENEVENTO (1754–1838), French diplomatist, descended from an ancient and illustrious family, was born at Paris. An accident in infancy, which lamed him for life, shutting out all hopes of a military career, he was educated for the priesthood at the Collège d'Harcourt, at St. Sulpice, and at the Sorbonne. His ready address, wit, and dexterity in managing men ensured his rapid advance, and, notwithstanding his open immorality, he became agent-general for the clergy in 1780 and Bishop of Autun in 1789. He was elected a deputy of the clergy to the States-General, and played a conspicuous part in the National Assembly, advocating the abolition of tithes, proposing the transference of Church lands to the State, and drawing up a report upon public instruction that served as a model for future changes in French education. In 1791 he was excommunicated by the Pope, and abandoned the clerical profession. Sent on a mission to England in 1792, he remained here as an *émigré* till the beginning of 1794, when he was expelled in accordance with the terms of the Alien Act. After eighteen months' exile in the United States, he was allowed to return to Paris, and in 1797 became Minister of Foreign Affairs. He was disgraced in 1799, but regained the office under Napoleon, who owed much to his diplomatic skill. In 1806 he was made Prince of Benevento, but, foreseeing the ruin which would follow from Napoleon's policy of conquest, he began to intrigue with the Bourbons, and eventually dictated the terms of the emperor's deposition. He was again Minister of Foreign

Affairs for a short time under Louis XVIII., both before and after the Hundred Days, and represented France at the Congress of Vienna, but resigned owing to the Royalist reaction. From 1830 to 1835 he was French minister in London. His *Memoirs* were published in 1891.

Tallien, JEAN LAMBERT (1769–1820), French revolutionist, was born in Paris. His *Ami des Citoyens*, a printed sheet fixed twice a week on the walls of Paris, attracted the notice of the revolutionary leaders, and, having played a prominent part in the attack on the Tuileries and the September massacres, he was elected to the Convention (September, 1792). After voting for the death of Louis XVI., and helping to bring about the overthrow of the Girondists, he was sent as proconsul to carry out the Terror in Bordeaux. Here he conceived a passion for the beautiful Comtesse Thérèse de Fontenay, who converted him to milder views and earned for herself the name of "Our Lady of Pity." Elected President of the Convention, after his return to Paris, he instigated the attack on Robespierre, and after his fall became for a time the most prominent figure on the political stage; but after the close of the Convention he ceased to exercise much influence, and he was soon afterwards deserted by his wife, the former Comtesse. In 1798 he accompanied Bonaparte to Egypt in an official capacity. On his return he was taken prisoner by the English, but was soon released. He died in great poverty.

Tallis, THOMAS (*circa* 1515–85), a celebrated English musician. Soon after the dissolution of Waltham Abbey (1540), of which he was organist, he became a gentleman of the Chapel Royal. He excelled in counterpoint, and founded the school represented by Orlando Gibbons. Of the thirty-four motets in the *Cantiones Sacre* (1575), sixteen were composed by Tallis and eighteen by William Byrd (q.v.).

Tally, a notched stick cleft into two halves, formerly used as a record of sales and loans, the parties to the transaction each retaining one half. The employment of tallies in the English exchequer began in the Norman period, and was not abolished by law till 1783. A square seasoned rod of hazel or willow was notched on one side, the size of the indentations corresponding with the amount of the coin or sum denoted. On two other sides, opposite to one another, were inscribed the sum paid (in Roman figures), the name of the payer, and the date of the transaction. The rod so marked was split down the middle, producing two exactly similar pieces, one of which (the "stock" or "tally") was given to the payer, the other (the "counterstock" or "countertally") remaining in the exchequer. When the debt was discharged, stock and counterstock were tied up together, and it was the burning of a large collection of these which caused the destruction of the old Houses of Parliament.

Talma, FRANÇOIS JOSEPH (1763–1826), French tragedian, was born in Paris, and made his *début* at the Comédie Française in 1787. His ascendancy,

acquired during the Revolution, was maintained under Napoleon and Louis XVIII. Among his finest impersonations were Marigny in *Les Templiers*, Sylla, and Charles IX.

Talmud (Hebrew "doctrine" or "study"), the code of ancient laws and traditions accepted by the modern Jews. It exists in two forms—the Talmud of Jerusalem and that of Babylon—each of which comprises two parts, the Mishna or text and the Gemara or commentary. The work of compiling the Mishna was undertaken by the school of Hillel, and finally completed under the superintendence of Rabbi Jehudah Hannasi about the close of the 2nd century A.D. It is divided into six parts (entitled "Seeds or Fruits," "Feasts," "Women," "Damages," "Sacrifices and Holy Things," "Purification"), embracing 63 treatises and 524 chapters. The Talmud of Jerusalem was produced at Tiberias, and is supposed to have reached its present form towards the close of the 4th century. The Babylonian Talmud, completed about 500 A.D., was the work of Rabbi Ashe, of the Academy of Sora, and his disciple, Rabina.

Tamarind (*Tamarindus indica*), a large leguminous tree, native of eastern tropical Africa and Australia, long cultivated in India (its name meaning in Arabic "Indian date"), and now grown also in the West Indies. In India it is valued as timber, its pinnate leaves yield yellow and red dyes, and its seeds are used as an astringent; but its most useful part is the pulpy interior of its pods, which contains citrate and tartrate of potash and sugar and has a mildly laxative action. The Black Tamarind of the East Indies has long pods containing six to twelve seeds, and is imported in a dried pressed state, chiefly for the manufacture of sauces. The Brown or Red variety of the West Indies has short pods with one to four seeds, and is imported in syrup. Our imports have diminished. Twenty years ago we imported 4,000,000 lbs. annually, Jamaica exporting some 15,000 lbs. as against a third of that amount at present. The finest quality is shipped from Barbadoes, that from St. Kitt's being inferior.

Tamarisk (*Tamarix*), a genus of shrubs which gives its name to the order Tamaricaceæ, distinguished by their twig-like branches, scale leaves, and spikes of small rose-pink flowers. The plant abounds in sulphate of soda, and in Arabia exudes a manna valued as a dainty by the Bedouins. *T. gallica*, a native of the Mediterranean area, occurs commonly along our English coasts; but is not indigenous. The bark is astringent, and some species also produce valuable galls.

Tambourine, a small drum formed of a ring of wood, over which is stretched a single head of parchment.

Tamerlane, TIMUR-I-LENG ("Lame Timur"), or TIMUR-BEG (1336–1405), a Tatar chieftain who established a vast empire in Asia. He was born forty or fifty miles south of Samarcand, which he made his capital in 1370. From this centre he overran Persia, extending his conquests to the Tigris and the Euphrates; subdued the Kipchaks

of Western Tartary, penetrating to the south-east of Russia, and added to his empire the north of India from the Indus to the Euphrates (1398). After defeating the army of the Mamelukes at Aleppo, and sacking Damascus and Bagdad, he gained a brilliant victory over the Ottoman Sultan, Bajazet, at Angora in Asia Minor (1402). He died on the banks of the Syr Daria whilst marching to achieve the conquest of China.

Tamil (TAMUL), next to the Telugu, the most numerous division of the Dravidian race, Southern India. [DRAVIDIANS.] The Tamils are concentrated especially in the Carnatic, in Travancore, and in the northern half of Ceylon, and the census of 1891 returned altogether 22,324,000 as of Tamil speech, of whom 21,600,000 were on the mainland and 724,000 in Ceylon. Tamil is the most harmonious, the richest, and most highly cultivated of all the Dravidian languages, with a literature ranging over a period of nearly 1,000 years, and abounding especially in poetic works, largely of an erotic character. It is written in a peculiarly graceful form of the Grandonic or Southern Devanagari, which has given rise to a great variety of syllabic alphabets current in India, Indo-China, and Malaysia. (Bishop Caldwell, *Grammar of the Dravidian Languages*.)

Tammany Ring. The American political organisation called the Tammany Society was founded in 1789, taking its name from Tamendy or Tammenund, a half-mythical Indian chieftain who lived in the days of Penn. It became a powerful instrument in the hands of the Democrats of New York; but, owing to the excessive number of delegates on the General Committee, the management of affairs was left to an inner circle or ring, headed by Mr. William M. Tweed, which gained a complete control over the municipal revenues. The frauds committed by the ring were fully exposed (mainly through the efforts of the late Mr. Louis Jennings, M.P., then editor of the *New York Times*) in 1871, and Tweed died in prison, but the organisation still retains much of its old influence.

Tanagers, a book name for the birds of the Passerine family Tanagridæ, mostly Neotropical, a single genus being widely spread over North America. There are about 400 species, distributed by Dr. Schlater into six sub-families. These birds are closely allied to the finches, but in many the bill is notched, and in some it carries a tooth. They are of small size, none being larger than a thrush, and of brilliant plumage, sometimes shared by the females. Tanagers are well-known cage-birds, and some have good powers of song.

Tanais, or the "Cheliferous Slater," a genus of Isopoda (q.v.), of interest as it is the only member of this order, or even of the whole of the Sessile-eyed Crustacea or Leptostraca (q.v.) and Arthrostraca (q.v.), which has a carapace or shield. This structure is usually characteristic of the Stalk-eyed Crustacea or Thoracostraca.

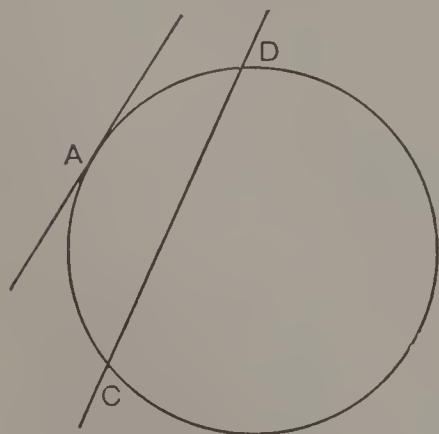
Tancred (1078–1112), a leader of the first crusade, was a son of the Marquis Odo or Eudes

and Emma, sister of Robert Guiscard. As a reward for his prowess, he received the principality of Antioch and afterwards that of Edessa. His virtues are highly extolled by the chroniclers, and he is one of the heroes of Tasso's *Jerusalem Delivered*.

Tandy, JAMES NAPPER (1740-1803), Irish revolutionist, was born in Dublin, and became secretary to the United Irishmen of that town in 1792. In 1795 he fled to America to avoid prosecution. Crossing to France in 1798, he took part in the abortive invasion of Ireland in that year, and after its failure made his escape to Hamburg. He was delivered up to the English, and after two trials condemned to death, but eventually he was allowed to settle in France.

Tanganyika, a long and comparatively narrow lake of East Central Africa, is situated in lat. 3° to 9° S., and long. 30° E., and occupies a kind of gorge, with a varying breadth of 15 to 80 miles, and a length of 420 miles, thus being the longest lake in the world. It lies 2,700 feet above sea-level, has 900 miles of coast, and has been found in parts to have a depth of 168 fathoms. It was discovered by Speke and Burton in 1858, and was considered to belong to the Nile basin; but in 1874 Cameron discovered a western outlet, Lukuga, which, he thought, communicated with the Congo. Stanley disputed the fact of this being a permanent outlet, and considered it to form only an occasional overflow, but Hore in 1880 decided that it was permanent. The water is fresh and good, and the climate fair, though the excessive evaporation causes an almost constant mist. The lake is subject to violent storms from the S.W., and is surrounded by mountains which rise to a height of 10,000 feet in places. The region is well-timbered, and has magnificent scenery, and animal life is abundant. The lake is between the Nile basin and that of the Zambesi, and has German and Portuguese possessions on the east, and the Congo Free State and British possessions on the west. A road leads from Lake Tanganyika to Lake Nyassa.

Tangent. A curve may be cut by a line in two or more points, and such a line is called



TANGENT.

a *chord*, but these points may be made to approach each other as the chord varies its position until at last they become coincident. When this occurs, the line is known as a *tangent* to the curve. In the case of a circle or any other conic section, the tangent touches the curve at two consecutive points.

These two points occur at A, the tangent there being the limiting case of the chord C D. In the case of a curve,

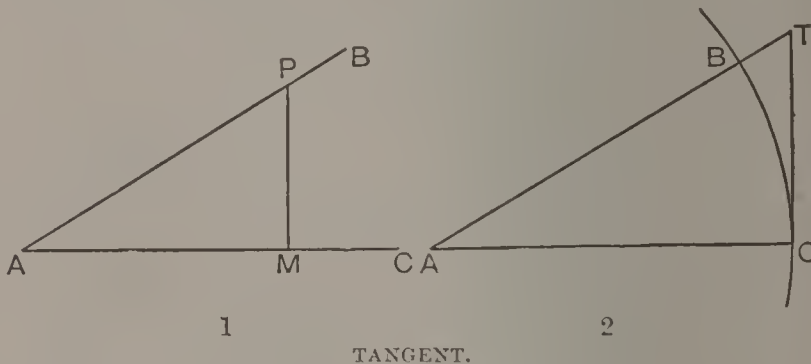
such as that formed by the letter S, for example, which can be cut by a straight line in three points, the tangent may touch it at three coincident points and cut it at the same time; or it may touch it at two coincident points and cut it at a third. This passing of the tangent from one side of the curve to the other will occur whenever a chord cuts the curve in an uneven number of points; when, on the contrary, a chord cuts it in an even number of points, the tangent leaves the curve on the same side as it met it.



TANGENT.

In trigonometry, the word tangent is used to denote a certain function of an angle. Thus, if B A C be any angle (1), and P M be drawn from any point P in A B perpendicular to A C, the ratio of the perpendicular P M to the base A M is known as the tangent of A. This is usually abbreviated into $P M = \tan A$. The old definition of tangent

was somewhat different from this. Thus, if B C were the arc of a circle whose centre was A (2), and if T C were the tangent to the circle at C, meeting the radius A B in T, then T C was said to be the tangent of the arc B C. Since it was



a line, and not a ratio, its value depended on the radius of the circle. The radius of the circle had therefore to be always given. The modern definition overcomes this difficulty, and the tangent of an angle has a perfectly constant value. In this case—

$$\tan A \text{ is } \frac{TC}{AC} = \frac{\text{tangent of the arc}}{\text{radius of the circle}},$$

which connects the values of the old and new functions.

Tangent Galvanometer. [GALVANOMETER.]

Tangier, a seaport of Morocco, is on the N.E. coast of Africa, on the Straits of Gibraltar, and at the N.W. of a bay, and 14 miles E. of Cape Spartel. The town has walls and a citadel, and rises in the form of an amphitheatre, presenting a pleasant view from the sea. The principal street leads from the Port Gate to the Market Gate, and a brisk trade goes on in the market. The other streets are narrow, and the architecture poor. There is a large trade with Gibraltar, the other industries

being the manufacture of woollen cloth, mats, and pottery, and there is some tanning. The climate is temperate and healthy, but there is at times a scarcity of water. Tangier formed part of the dowry of Catherine of Braganza, but was abandoned by England in 1694. Colonel Kirke, with his "Lambs," was quartered here, and the Royal West Surrey regiment still carries the Lamb and Flag in commemoration; while a spot at Taunton, where the regiment was stationed in the Monmouth campaign, still bears the name of Tangier.

Tangutans (*i.e.* "Dwellers in houses"), a term formerly applied by the Mongolian nomads (dwellers in tents) to the Tibetans in general, but now restricted to the north-eastern branch of that race in the West Kansu uplands, the Koko-Nor, Tsaidam, and Upper Hoang-ho basins. This region is supposed to be the original home of the Tibetans, who migrated southwards to Lhasa about 400 B.C. In mediæval times the Tangutans, who always call themselves *Bod-pa*, like all other Tibetans, rose to great power and established a strong kingdom, which about coincided with the limits of the Chinese province of Kansu taken in its widest sense. They are described by Prjevalsky as of somewhat gipsy-like appearance, above the mean height, with thickset figures, broad shoulders, large dark eyes, straight and even aquiline nose, long face, thick beard and whiskers, and tawny complexion. (*Mongolia*, vol. ii. p. 136.)

Tank-Worms, the young larvæ of the Guinea-worm (*q.v.*) or *Filaria*, a parasite common in man in tropical countries, where it causes the disease known as hæmaturia. Its popular name is derived from the fact that the larva lives in mud in the bottom of tanks and pools.

Tannhäuser, a Bavarian knight of the 13th century, who resided as minnesinger at the court of Frederick II., Duke of Austria. Through some unknown circumstances in his life he became the central figure in an ancient legend, supposed by Grimm to typify the early struggle between Christianity and Paganism. In the course of his wanderings Tannhäuser arrives at the mount of Lady Venus and there lives in luxury and self-indulgence, but at last repents of his evil courses and repairs to the Pope at Rome to seek absolution. The Pope tells him that the budding of his staff would be a less miracle than Tannhäuser's forgiveness, whereupon the knight returns in despair to the fairy court. Three days afterwards the staff buds, but all the Pope's endeavours to find Tannhäuser are fruitless.

Tannic Acids. A number of compounds, all intimately related, are known under the name of tannic acids or *tannins*. They occur widely diffused in the vegetable kingdom, being found in a large variety of plants—*e.g.* nutgalls, sumach, tea, coffee, and many woods. They are soluble in water, the solution possessing acidic properties and a strong astringent taste. With solutions of ferric salts they give an intensely deep blue or green coloration or precipitate. They possess the power of combining with skins of animals, and so rendering them

incapable of putrefaction. To this quality their usefulness in leather-making is due. Most of them break up when acted on by dilute acids, forming gallic acid and grape-sugar with other products. They thus belong to the class of compounds known as *glucosides* (*q.v.*). Ordinary tannic acid is obtained chiefly from nutgalls by finely powdering and extraction with commercial alcohol and ether. A solution of the tannin in the water present with these sinks to the bottom and is collected. It is a colourless compound, very soluble, which decomposes into *pyrogallie acid* if heated. Its reactions prove its constitution to be that of *digallic acid*, $C_{14}H_{10}O_9$. It is used to a large extent in dyeing, calico-printing, in tanning, and for the manufacture of ink (*q.v.*).

Tannins. [TANNIC ACIDS.]

Tansy (*Tanacetum vulgare*), a handsome British perennial composite plant, growing about two feet high, with much cut pinnate leaves and corymbs of golden, button-like, rayless capitula. The whole plant is strongly aromatic and bitter, and was formerly made into a wine valued as a stomachic and put into various puddings and cakes.

Tantalum, a rare metallic element which was discovered in 1802, in some rare minerals known as *tantalite* and *yttrotantalite*. The metal itself has been obtained as a black powder of specific gravity 10.8, which burns if heated in air or in chlorine gas. It is unacted on by acids, with the sole exception of hydrofluoric acid. It forms a number of oxides, one of which—the pentoxide Ta_2O_5 —acts the part of an acid oxide, uniting with bases to form salts known as *tantalates*. It forms also a *nitride* TaN , a metallic-like compound. The atomic weight of tantalum is still uncertain, but it appears to lie between 182 and 183.

Tantalus, a character in Greek mythology who was allowed to be present at a banquet of the gods. As a punishment for some offence committed on this occasion, he was punished in the lower world by standing up to the neck in water, which ever receded from his thirsty lips, whilst above him branches laden with fruit dangled just beyond his reach; hence the verb "tantalise."

Tapestry, an ornamental fabric of the textile class, much used during the Middle Ages as a material for curtains and hangings, and to cover the walls and furniture of churches and baronial halls. The weft, which may represent any scene drawn from nature, history, or domestic life, is worked on the warp by a process essentially the same as that followed in weaving (*q.v.*). The material is usually silk or wool of various tones and hues, and in former times the design was frequently wrought in gold or silver thread. It is incorrect to use the term of fabrics in which the weft is produced by means of the needle. The art appears to have been introduced into Europe by the Saracens; hence the term *Sarazinois* applied to the fabric in mediæval times. From Flanders, where it had taken root in the latter part of the 12th century, it was carried to various parts of Western Europe by the refugees who were driven from their fatherland

by the tyranny of the Spaniards. "Arras," which long survived as a general name for European tapestry, recalled the Flemish town which had been especially noted for its manufacture. Since the early part of the 17th century the highest class of tapestries have been produced at the famous Gobelins (q.v.) works in France. Tapestry-weaving is said to have been introduced into England in the reign of Henry VIII., and a manufactory existed at Mortlake from 1619 to 1703.

Tapeworms are a group of worms the members of which live as parasites in the intestines of different vertebrates. They belong to the class of Cestoidea, in the article on which is an account of their anatomy and life-history. The typical forms belong to the family *Teniidae* and the genus *Tenia*. The connection between the cystic and tapeworm stages was proved by experiments by Küchenmeister in 1851, who fed cats and dogs with cysts found respectively in mice and rabbits. There are seven families of Tapeworms, of which that of the *Teniidae* is the chief. Some, such as the *Diphyllidae* and *Tetraphyllidae*, are parasitic only on fish. Of the three adult forms occurring in the human subject, the *Tenia solium* and the *Tenia medio canellata* are the most common; the third form, the *Bothriocephalus latus*, is met with only in certain parts of Europe, and is very rarely seen in this country. The *Tenia solium* may attain to the length of 8 or 10 feet. The larval form of this tapeworm is known as the *Cysticercus cellulosæ*. It inhabits the muscles of the pig, rendering the flesh "measly," as it is called, and the consumption of such "measly pork," in an imperfectly cooked state, is the cause of the introduction of the tapeworm into the human intestine. The larval form sometimes occurs in man, and in that event it is usually the muscles, brain, or serous membranes which are affected. The *Tenia medio canellata* resembles the *Tenia solium* in many ways. Its head is thicker, however, and it has no hooklets. The larval form of this worm occurs in the ox tribe. The presence of tapeworms in the human intestine may give rise to many symptoms of a variable and indefinite character; the diagnosis of their existence can only be certainly made by detecting their joints in the stools or by the discovery of the ova on microscopic examination. The remedy usually employed to expel the worm is the liquid extract of male-fern, a powerful drug, which should only be taken under professional advice.

Tapioca, the partly-torrefied, agglomerated starch of the Cassava or *Manihot*, forming a light, pleasant farinaceous food. It is prepared, in Brazil, Peru, Guiana, Africa and Penang, from the large tubers of the euphorbiaceous *M. utilisissima*, the Bitter, and *M. Aipi*, the Sweet Cassava, and contains 83 per cent of starch. Its starch is partly converted into dextrine in the process of manufacture, which consists in heating the cassava starch on iron plates. An imitation is prepared from potato-starch. We import about £3,000 worth from Brazil, and other qualities from Singapore, the varieties

being known as "flake," "pearl," and "flour." Our imports altogether exceed 7,000 tons annually.

Tapir, any individual of the genus *Tapirus* of the odd-toed division of Ungulates, with four species from America and one from the Oriental region. In form they are somewhat like large pigs. the ears are short, the eyes small, and the snout is produced into a short flexible proboscis used for gathering their vegetable food. The fore limbs bear four and the hinder ones three digits. In habit the tapirs are solitary and nocturnal, frequenting the depths of forests and the banks of



TAPIR. (*Tapirus Americanus*.)

lakes and rivers, the latter situation affording them opportunities for bathing and a place of refuge when pursued, for they are hunted for their skin, which makes excellent leather, and for their flesh, which is good eating. The American Tapir (*T. americanus*), from Brazil and Paraguay, is the best-known species; there are two others from Central America, and one from the high region of the Andes. Their colour when adult is dark-brown, but their young and those of the Malayan Tapir are marked with light spots and stripes on a dark ground. The Malayan Tapir (*T. indicus*), from the Malay Peninsula, Sumatra, and Borneo, has the body white, with the head and limbs glossy black.

Tapping. The removal of collections of fluid from the cavities of the pleura or peritoneum, or from cysts, hydroceles, abscess cavities, etc., is effected by the operation of tapping. This operation is usually performed with a trocar and cannula [CANNULA], sometimes in conjunction with some form of apparatus known as an aspirator, designed to promote the outflow of fluid by suction into a partial vacuum.

Tar, a product of the destructive distillation of organic substances intimately related to the natural asphalts and bitumens (q.v.). There are two chief varieties, *coal-tar* (q.v.) and *wood-tar*. Wood-tar is a dark-brown or black, semifluid, pungent, acid substance, consisting of a mixture of heavy, non-volatile hydrocarbons. It is mainly obtained from the roots and stools of *Pinus sylvestris* in Northern Europe, where it is known as Stockholm and Archangel tar, and from those of *P. palustris* in the Southern United States. It is extracted by a slow combustion of the wood when

covered with turf; or more economically in closed retorts, for which the gas evolved serves as fuel. In the latter method roots yield 16 to 20 per cent. of tar, and on further distillation tar yields wood vinegar, acetic acid, creosote, and oil of tar, leaving a residue of the black, brittle, glossy solid known as pitch. Tar and pitch are largely used for the protection of shipping and other timber from the weather, and the latter also in Berlin or Brunswick black. Tar contains also some pyrocatechin, which is soluble and gives to tar-water the slight medicinal virtue which was so enthusiastically overstated by Bishop Berkeley (q.v.).

Tarahumaras, a Mexican people widespread in the states of Sonora, Sinaloa, Chihuahua, and Durango, are a branch of the Opata-Pima family, remarkable for the tenacity with which they have adhered to the old national usages and language. Some are even still cave-dwellers, though the great majority are now "Mexican citizens" and nominal Christians; but they still observe some of the old rites, which, despite the protests of their pastors, are accompanied by the sacrifice of a sheep or a calf. The Tarahumaras, *i.e.* "runners," are passionately fond of such public games as involve trials of skill and endurance. At tribal gatherings foot-races and other sports are often kept up for days together. In the state of Chihuahua, where they are most numerous, they still number about 40,000.

Taranchi, a Mongolian word meaning "peasants," applied specially to the settled agricultural populations of Chinese Turkestan and Kulja. All speak dialects of the Turki language of East Turkestan, and in the north they are of distinct Mongolo-Tatar type, but in the south (Kashgaria) they have been largely assimilated to the Tajiks (q.v.), so much so that they have been called Iranians of Turki speech. Although Mohammedans, they retain many of the old usages; the women go unveiled and polygamy is little practised. Since the retrocession of Kulja to China large numbers have crossed the frontiers, and are now settled in Russian territory. (Kuropotkin; Ch. de Ujfalvy.)

Taranto (ancient *Tarentum*) is an Italian seaport in the province of Lecce, and is situated between the Gulf of Taranto and an inlet called the Mare Piccolo, being joined by a bridge to the mainland on the E., there being a sheltered harbour to the E. of the town. The town is 72 miles S.E. of Bari, a port on the Adriatic coast. At the entrance of the harbour are the islets S. Pietro and S. Paolo, and Cape San Vito is on the S.E. Among the chief buildings are a cathedral and a castle. The principal industries are oyster and mussel fishing, and honey and fruits are largely produced. The ancient city, which extended far beyond the limits of the present town, was noted for its wool, purple, and pottery, and was founded by a colony of Spartans in 708 B.C., soon becoming the chief city of Magna Græcia. Archytas, head of a school of Pythagorean philosophy, dwelt here in 400 B.C. After many quarrels with neighbouring cities

Tarentum came into collision with Rome in 281 B.C., and was taken in 272. For siding with Hannibal in 207 B.C. the city was heavily punished, and from that time lost its importance. Subsequently it formed part of the Byzantine Empire—a relic of which consists of an aqueduct from the town to the mainland—passing then successively to the Saracens, Norman adventurers, and to the kingdom of Naples, as part of which it passed to the present kingdom of Italy.

Tardigrada, Illiger's name for a group containing the sloths. [SLOTH, WATER-BEAR.]

Tares (*Vicia sativa*), also known as *vetch* (q.v.), a commonly-grown green fodder-plant, with sessile, solitary papilionaceous flowers and smooth black seeds. We import over 400,000 bushels of these seeds from the Continent as food for horses and poultry. The two allied British weeds *V. hirsuta*, with a two-seeded pod, and *V. tetrasperma* are known as the *hairy* and *smooth tare* respectively.

Targum, the name given to the paraphrastic translations of the Old Testament from Hebrew into Aramaic. They were rendered necessary by the Babylonish exile, during which the Jews had forgotten their native language. The practice of translating and expounding the original text is supposed to date back to the time of Ezra, and is probably alluded to in Nehemiah viii. 7-9. For many centuries they were handed down by oral tradition, and probably the greater number were never committed to writing. The valuable targum of Onkelos on the Pentateuch, which is supposed to be the most ancient, probably does not date farther back than the latter half of the 2nd century A.D.

Tarifa, a seaport of Spain, is the most southerly point and town of the peninsula, in the district of Andalusia and the province of Cadiz, and 21 miles S.W. of Gibraltar. The town, which presents evident traces of Moorish occupation, is connected by a causeway with a small island upon which are a fortification and a lighthouse, 130 feet high, throwing a light to a distance of 30 miles. The chief industries are tunny- and anchovy-fishing, leather-making, and the growing of sweet oranges. It became a Moorish possession in 710 A.D., and was taken by Spain in 1292. General Gough defended it against a French army in 1812.

Tarn, a French department of the south, having Aveyron and Tarn-et-Garonne on the N., Haute-Garonne on the W., Aude on the S., and Hérault on the E. It contains 2,217 square miles, and the northern part is traversed from W. to E. by the river Tarn. The surface is generally lofty, and in the S. and S.W. offshoots of the Cevennes rise to a height of over 4,000 feet. The mountains are well wooded, and the vine is extensively cultivated on the hills. There are fertile alluvial valleys and fine forests of beech and oak. The chief productions are grain, potatoes, fruit, wine, cattle, geese, turkeys, and cheese; coal, marble, etc., are among the minerals; and among the chief industries are the manufacture of wool, silk, steel, glass, and pottery, and dyeing. The department is divided into four arrondissements, and has for its capital Alby.

Tarn-et-Garonne, a department of Southern France, lying to the N.W. of Tarn, and traversed from S.E. to N.W. by the Garonne with its tributaries Tarn and Aveyron. The surface has tablelands varying in height from 1,000 to 1,600 feet, and the climate is temperate. The chief productions are corn, wine, honey, fruit, hemp, and lithographic stones; and the principal industries are the manufacture of silk, paper, candles, and soap. The capital is Montauban, near the junction of the Garonne and Aveyron, and there are three arrondissements.

Tarquinius Priscus, fifth mythical king of Rome, was born at Tarquini, in Etruria. He is said to have reigned from 615 to 577 B.C. His son, **TARQUINIUS SUPERBUS**, seventh king, ascended the throne after murdering his father-in-law, Servius Tullius. The shameful conduct of his son Sextus, in the outrage of Lucretia, led to the expulsion of the family from Rome about 510 B.C.

Tarragon (*Artemisia Dracunculus*), a worm-wood (q.v.) differing from most of its allies in having undivided leaves and in not being bitter, is a native of Siberia, cultivated a little in England and universally in France as an ingredient in salads and pickles, and for flavouring vinegar.

Tarragona (Roman *Tarraco*) is a seaport of Spain, capital of the province of Tarragona, in Catalonia, 60 miles W. of Barcelona, and pleasantly situated at the mouth of the small river Francolí. There is a good shipping trade, the annual tonnage of the port amounting to half a million. The old town, which is dirty and irregular, and is surrounded by ramparts, is separated from the new and well-built new town by a broad street. The 12th-century cathedral is a fine specimen of Gothic architecture, and is 300 feet long by 100 feet wide. The principal industries are the spinning and weaving of silk and jute, and the making of felt and lace. Tarraco was the capital of a Roman province, and among the Roman remains are an aqueduct, the tower of the Scipios, and an amphitheatre, much of the stone of which was used in constructing the mole. The modern town suffered much in the Peninsular War.

Tarshish, a town of antiquity, supposed to have been situated in Spain, near the mouth of the Guadalquivir; and the name is thought to have included all Andalusia. Some, however, have thought the Biblical Tarshish to have been situated in Arabia; others have identified it with Tarsus.

Tarsier (*Tarsius spectrum*), a lemur-like animal from the Eastern archipelago. In size it is rather less than a squirrel; the ears and eyes are large, the tail is long and thin, and the colour fawn-brown.

Tarsipes, a phalanger from Western Australia. It is about the size of a mouse, with protrusile tongue and prehensile tail, and feeds on insects and wild honey.

Tarsus, an ancient city, situated amid fertile surroundings, in Cilicia, upon both banks of the Cydnus, whose cold waters are celebrated as

having caused the death of Alexander the Great. The names of the deities worshipped and the nature of coins that have been discovered on the site, show the city to have been of Semitic origin, but it gradually became Hellenised, and in the time of Xenophon was in a prosperous condition. It was noted for its school of philosophers both Stoic and Platonic, among them being Athenodorus and Zeno, and St. Paul came into contact with some of its members. At a later period the general tendency of the city's philosophy was Epicurean. Tarsus became Roman in 66 B.C., and many privileges were conferred upon it by Antony and Augustus. In early Moslem days the city decayed and fell into ruins, but was rebuilt in 787 A.D. by Haroun Alraschid. It passed into the hands of the Crusaders, and eventually fell to the Turks.

Tartar Emetic is a salt of tartaric acid, $C_4H_6O_6$, in which one atom of hydrogen is replaced by potassium and another by oxide-radical of antimony (SbO). It thus possesses the formula $C_4H_4O_6K(SbO)$. It is easily soluble in boiling water, and considerably less so in cold water. It crystallises in shining rhombic forms of composition $2C_4H_4O_6K(SbO) + OH_2$, but the crystals on exposure lose their water of crystallisation and fall to a white powder. It is prepared by boiling antimony oxide with water and cream of tartar. Its solution has a peculiar taste, and the compound is used to an extent medicinally as an emetic and sudorific. [TARTARIC ACID.]

Tartaric Acid. The ordinary variety of tartaric acid is a compound which occurs very widely in the vegetable kingdom, being found in many fruits. It is most abundant, however, in grapes, where it exists as an acid potassium salt, which thus forms a deposit in wine-casks, which is known as *argol*. From this argol most of the commercial tartaric acid is obtained. The acid is a dibasic acid, possessing the formula $C_4H_6O_6$ or $[CH(OH)CO_2H]_2$. It forms crystals of the monoclinic system, which dissolve easily in water. Its solution acts on polarised light, being what is known as dextrorotatory. It melts at 180° , and is converted into an amorphous form known as *meta-tartaric acid*. It forms a series of salts known as tartrates; of these the acid potassium salt is almost insoluble in water, and is formed as a white precipitate when the acid is added to a solution of a potassium salt. It is well known under the name of *cream of tartar*. A double salt of potassium and sodium is known under the name of Rochelle salt or Seignette's salt; while a compound with oxide of antimony is employed medicinally as *tartar emetic* (q.v.). Besides this ordinary variety, a form which melts at 167° , and is levorotatory, and also a form which does not act upon polarised light, are known. A mixture of the two active forms usually results from the artificial preparation of the acid, and is known as *racemic acid*. It very closely resembles the ordinary tartaric in all its properties, and by certain chemical methods may be separated into its two active constituents. Other such compounds, also consisting of a mixture of two optically active compounds, so as to form an

apparently inactive substance, are known by the general term of *raccmates*.

Tartini, GIUSEPPE (1692-1770), musical composer, was born at Pisano in Istria. In 1721 he became leader of the orchestra in the church of San Antonio at Padua. He composed numerous concertos and sonatas, including the famous *Devil's Sonata*, and wrote treatises on music (1754) and harmony (1767).

Tasmania, called after its discoverer, Tasman (1648), who gave it the name Van Dieman's Land, after the Governor of Java, is an island lying to the S. of Victoria in Australia, being separated from it by the Bass Strait. Including the islands in the Bass Strait, Tasmania contains 24,600 square miles. The N. and N.W. are hilly and mountainous, as are parts of the S. and E., and in the centre are groups of hills, covered with scrub and forest, and having lakes at an altitude of 4,000 feet. The highest points in the island are Ben Lomond (5,020) in the E.; Frenchman's Cap (4,706) W.; Cradle (5,069) W.; Wellington (4,170) E. The chief rivers flowing N. are the Tamar, Inglis, Carn, Don; from the E. the Macquarie flows into the South Esk, and the two Esks unite at Launceston to form the Tamar; to the W. are the Hellyer, Arthur, and Pieman; and in the centre and S. are the Derwent, Clyde, Ouse, etc. The Great Lake is 50 miles in circumference, and other lakes are Sorell, St. Clair, Crescent, and Echo. The island is divided into 18 counties, and the principal towns are Hobart, in the S., on the Derwent, and Launceston, in the N., on the Tamar. The climate on the whole resembles that of England, but is more sunny, and the E. districts are very dry, and the W. regions wet, though the whole is healthy. The lake districts have a climate very like that of the Scottish Highlands. The dense forest and tangled scrub that occupy much of the surface made Tasmania in times past a favourite haunt of bushrangers. Strong winds prevail on the S. and W. coasts. The island is geologically connected with Victoria, and among the minerals are tin and coal in abundance, gold, lead, copper, antimony, zinc, silver, manganese, plumbago, and asbestos. Freestone is exported, and tin, and Tasmania produces enough coal for its own consumption, and also an inflammable resin called tasmanite. The animals resemble generally those of Australia, with the exception of the dingo, and the addition of the Tasmanian devil and tiger. The forests produce tree-ferns, wattle, fragrant evergreens, and other trees found in South Australia, and the blue gum is largely employed in ship-building. Formerly there was much whaling and sealing, but this has fallen off, and there are excellent trout and other fish. Agriculture, the breeding of merino-sheep, and the growing of hops and fruit are carried on. Much fruit is now exported to England. Other exports are wool and metals. There are good roads and railways, and among the industries are tanning, sawing, brewing, and jam-making. Tasmania was settled from Sydney, and became a separate colony in 1825. The aborigines of Tasmania were nearly exterminated by the white settlers during the "Black

War" of 1805-35. The few survivors were removed to the Flinders Archipelago, where they rapidly died out, and "Lalla Rookh," last of the race, died at Hobart in 1876. The Tasmanians, who at the arrival of the Europeans (1803) numbered not more than 5,000 altogether, showed both Australian and Melanesian affinities, and were probably a mixture of the two races with some marked peculiarities due to long seclusion in their isolated environment. The hair was crisp and even woolly, the colour very dark, the frame larger and more powerful than that of the average Australian, while the language, of which some specimens have been preserved, contained several words of New Caledonian (Melanesian) origin, though the structure was rather Australian. The natives were scattered in small tribal or family groups, chiefly round the coast, and stood at an extremely low stage of culture. (J. Bonwick, *The Last of the Tasmanians*, 2nd edition, 1884.)

Tasmanian Devil. [DASYURE.]

Tasso, BERNARDO (1493-1569), Italian poet, belonged to an ancient family settled at Bergamo. He attached himself to the Duke of Ferrara, and subsequently to the Prince of Salerno, under whose protection he settled at Sorrento. Here he composed *L'Amadigi*, an epic in the style of Ariosto, founded on the Spanish romance *Amadis de Gaula*. Having taken part in resisting the Inquisition, he was expelled from Sorrento, 1547. His last years were spent in the service of the Duke of Mantua.

Tasso, TORQUATO (1544-95), the last great poet of Italy, was born at Sorrento. He was educated by his father, Bernardo Tasso, and afterwards studied law at Padua, but devoted most of his time to the composition of his narrative poem *Rinaldo* (1562). In 1565 he entered the service of Cardinal Luigi d'Este, who took him to the castle of his brother, Alfonso II., Duke of Ferrara. After visiting France with the Cardinal in 1570, he transferred his services to Alfonso, and in 1573 published *Aminta*, a pastoral play of much lyrical beauty intended for representation at the ducal court. His religious epic *La Gerusalemme Liberata*, one of the great poems of the world, in which romantic episodes are deftly interwoven with the facts of history, was completed in 1574. His health now began to give way, and in 1577, owing to his strange delusions and want of self-control, he was placed in a Franciscan convent at Ferrara. It was formerly believed that his madness—if madness it was—resulted from a hopeless passion for the duke's sister, the Princess Leonora, but of this there is no evidence, and the truth probably is that his sensitive and irritable nature was unable to bear the jealousy of courtiers, the strain of composition, and the fatuous advice offered by his pedantic critics. He soon escaped from his confinement, and after a brief return in 1578, during which he consented to submit to medical treatment, he made his way through Mantua, Padua, Venice, Urbino, and Lombardy to the Duke of Savoy at Turin. In 1579, on the occasion of the duke's third marriage, he again returned to Ferrara,

but his conduct was so violent that he was imprisoned in the madhouse of St. Anna, where he remained for seven years. His release in 1586 was due to the intercession of the Duke of Mantua. After a brief sojourn at his court, he passed the remainder of his life in aimless wanderings through Italy, dying at Rome when he was about to receive the laurel crown from Pope Clement VIII.

Taste. The end organs of taste are chiefly located in the tongue (q.v.). The nerves concerned are the glosso-pharyngeal and certain branches of the fifth nerve. Most of the sensations of taste are to a large extent dependent upon the sense of smell: there are, however, four primary taste sensations apart from olfactory sensations, which are classed as the sensations of sweets, bitters, acids, and salines.

Tatar (TATA, TARTAR), one of the most involved terms in the whole range of ethnology. The original form appears to be *Tata*, plural *Tatar*, a Manchu or Tungus word, meaning either "archer" or "nomad," and occurring as early as the 9th century A.D. in Chinese records in reference to certain Mongol tribes, which later were driven by the Khitans southwards to the In-Shan Mountains, about the great bend of the Hoang-ho river. Here the predatory Mongols and Tatars, all closely related nomads of Mongolic stock and speech, lived in association and spread the terror of their name amongst all the surrounding peoples, long before the time of Jenghiz Khan, who gave them a world-wide celebrity. Jenghiz himself was of the Mongol tribe on his father's side, and of the Tata (Black or original Tata) tribe on his mother's side, and the result of his conquests was that the term Mongol became dominant in the east, and Tata in the west, which was largely due to the fact that the Tatas generally formed the van of the Mongol expeditions westwards. At an early date Tatar took the form *Tartar*, and thus became associated with the *Tartarus* of classic mythology, as in the letter of Louis IX. to Queen Blanche (1241). But a far more important change was its gradual transition from the *Mongol*, or eastern, to the *Túrki*, or western division of the Ural-Altaic race, so that Tatar, originally the name of a Mongolic tribe, is now exclusively used to designate peoples of Túrki stock and speech. The change was analogous to that by which the Teutonic *Frank* became the Romano-Gallic *French*, and was due to analogous causes—Tatar and Frankish dynasties on the one hand, Túrki and Romano-Gallic subjects on the other. The powerful Kipchak Empire, founded by Batu-Khan, grandson of Jenghiz, stretching from West Siberia to the Black Sea, was mainly inhabited by Kumans, Pechenegs, and other Túrki peoples, and when the empire was broken into fragments, each section still continued to be ruled by Tatar (Mongol) Khans, and to be called Tatar Khanates. Thus originated the expressions "Siberian Tatars," Kazan, Astrakhan, Krim (Crimean), and other Tatars, meaning Túrki peoples ruled by Tatar princes of Jenghiz Khan's dynasty. But the peoples themselves have always disclaimed the title of Tatar, calling themselves

and their language *Túrki*, never *Tatari*. Consequently *Túrki* has again become the collective name of the western division of the "Mongolo-Tatar" family, although Tatar still continues to be applied, especially by Russian ethnologists, to the Túrki peoples of Siberia, of the Volga (Kazan, Astrakhan), of the Crimea, of Caucasia, Lithuania, and Poland. The Manchu conquerors of China, with whom the name probably originated, are also frequently and correctly spoken of as Tatars. But the word has been properly banished from geographical nomenclature, except, perhaps, in the extreme east, where the expression "Gulf of Tartary" still lingers on some European maps. [TÚRKI, URAL-ALTAIC.]

Tate, NAHUM (1652–1715), was born in Dublin. In 1692 he succeeded Shadwell as poet-laureate. He is remembered only as the author of a metrical version of the Psalms (1696), which was gradually adopted in churches in place of that of Sternhold and Hopkins.

Tatian (circa 110–180), a Christian apologist and heresiarch, was born in Assyria. He became learned in Greek literature and philosophy, and adopted the life of a travelling sophist. His conversion, which took place at Rome about 150, was due to the study of the Old Testament and the example of his Christian friends. He attached himself to Justin Martyr, and during his lifetime (probably in Greece about 153) produced the *Oratio ad Græcos*, an apology for the Christian religion. His Gnostic and ascetic tendencies, which came to a head about 172, occasioned his withdrawal to Mesopotamia, where he opened a school, probably at Edessa. He afterwards became the leader of the Encratites. His *Diatessaron*, composed of materials furnished by the four evangelists, throws much light on the history of the canon.

Tatius, ACHILLES, an Alexandrian Greek of the 3rd or 4th century A.D., author of *Leucippe and Cleitophon*, a romance in eight books.

Tattooing, the practice of pricking the skin and filling the punctures with colouring matter, so as to produce an ornamental design. The Tahitian name of these patterns is *tatau* (from *ta*, "a mark"). The custom prevails throughout a great part of Oceania, and is also followed by the Chinese, Japanese, and Burmese, and aborigines of North and South America. From its prohibition in Lev. xix. 28, it may be gathered that it was known to the races with whom the Israelites were brought in contact. The tattoo sometimes has a religious or social significance; among the Polynesians, for instance, it frequently represents the totem (q.v.) of the clan to which the wearer belongs. Tattooing is very common in Europe, not only amongst sailors, who may have learnt it from savage tribes, but throughout the whole male portion of the lower strata of the population.

Tauler, JOHANN (circa 1300–61), German mystic, was born at Strasburg, and entered the Dominican Order. In early life he appears to have been a pupil of Meister Eckhart. When the Dominicans were expelled from Strasburg owing to

their resistance to a Papal interdict, Tauler withdrew to Basel, where he became associated with the Friends of God. The influence of this fraternity is seen in the practical bent which distinguished him during the remainder of his life. It is especially marked in the *Sermons*, which form one of the earliest monuments of German prose literature.

Taunton. 1. A municipal and parliamentary borough (one member) of Somerset, is upon the Tone, in the valley called Taunton Deane, 45 miles S.W. of Bristol. A fortress was erected here in 710. and a castle was built upon its site by a Bishop of Winchester in the 12th century. In times past Taunton was one of the West of England "clothing" towns, and still has some manufactures of shirts, collars, gloves, and silk, and is the centre of an important agricultural district. The church of St. Mary Magdalen, built in 1500 and restored 1858-62, is renowned for its noble Perpendicular tower, 153 feet high. Other important buildings are the Elizabethan shire hall, the municipal buildings, the King's College, the Independent College, other schools, and the barracks. The town is of much historic interest. In 1497 Perkin Warbeck was in it; in 1644 Blake; Monmouth made a triumphal entry, and in 1685 Judge Jeffreys held here the noted "Bloody Assize."

2. The capital of Bristol county, Massachusetts, U.S.A., is situated upon the river Taunton, 34 miles south of Boston. It owes its name to the fact of having been settled from Taunton, England, in 1637. Among its notable features are the park, the city hall, and the State lunatic asylum. It has foundries, cotton-mills, locomotive works, copper works, ship-yards, brick-fields, nail factories, etc.

Tautog (*Tautoga onitis*), a valuable North American food fish of the Wrasse family, from the Atlantic coast. It is black on back and sides and whitish beneath, and attains a weight of from 12 lbs. to 14 lbs.

Tavernier, JEAN BAPTISTE, BARON D'AUMALE (1605-89), traveller, was born in Paris, the son of a designer of maps who had migrated thither from Antwerp. He made several journeys to the East, visiting Turkey, Persia, Hindustan, and the Dutch Indies, and amassed great wealth as a trader in jewels. He was ennobled by Louis XIV. in 1669, and in 1670 purchased the barony of Aubonne in Switzerland. In 1684 he visited Berlin for the purpose of establishing a company to trade in the East, but this scheme collapsed. He died at Moscow on a journey to settle his affairs in the East. His *Six Voyages* (1676) and *Recueil* (1679) were valuable for their commercial information, and did much to promote French trade with the Indies.

Tavistock, a market-town of South Devon, is on the River Tavy, in a valley W. of Dartmoor, 11 miles N. of Plymouth, and 31 S.W. of Exeter. It was a "stannary" town, and was once the centre of an important mining district. Among the chief buildings are a 14th-century church, with a tower 106 ft. high built upon arches, the Guildhall, and Kelly College. There are statues of Drake (who was a native) and of a Duke of Bedford. Pym and

Lord William Russell were members for Tavistock in its more important days. There are the ruins of a Benedictine Abbey, founded 961 by Queen Elfrida's father, and rebuilt at a later period. This passed at the Dissolution into the hands of the Russell family, and still belongs to the Duke of Bedford.

Tax, an impost exacted by the sovereign or ruling body of a country either for public or private ends. The principles which should guide the Government of a civilised country in the matter of taxation were formulated by Adam Smith in four famous maxims: (1) "The subjects of every State ought to contribute towards the support of its Government as nearly as possible in proportion to their respective abilities; that is, in proportion to the revenue which they respectively enjoy under the protection of the State." (2) "The time of payment, the manner of payment, the quantity to be paid, ought all to be clear and plain." (3) "Every tax ought to be levied at the time or in the manner in which it is most likely to be convenient for the contributor to pay it." (4) "Every tax ought to be so contrived as both to take out and to keep out of the pockets of the people as little as possible over and above what it brings into the public treasury of the State." Taxes are usually distinguished as *direct* or *indirect*. According to J. S. Mill, a direct tax is one "demanded from the very persons who it is intended or desired should pay it," whereas in the case of an indirect tax the actual payer is able to shift the burden on to another. The income-tax and dog-tax are examples of the former class, customs and excise duties of the latter. Each system of raising taxes is attended with certain advantages and disadvantages. In favour of direct taxation it may be said that it is more easily adjusted to the resources of the payer, while, on the other hand, the incidence of indirect taxation being less obvious, it is not resented in the same manner by the person who really suffers by it. The right of determining the annual amount of the public revenue and the methods by which it shall be raised has from time immemorial belonged to the House of Commons. The drawing up of the "Budget" is the function of the Chancellor of the Exchequer. Taxes raised for local purposes by municipal and other local authorities are called rates.

Taxation of Costs. There are certain officers of the various Courts of Justice appointed for the taxation of costs; thus in the High Court the Masters fill that office, in the County Courts the Registrars. When a master or registrar has taxed the costs, and has deducted what he has thought proper to disallow from the gross amount, he marks down the remaining sum which is to be allowed, and this document is thence called the master's allocatur. There are two ways of taxing costs: (1) As between solicitor and client, which is the more liberal; (2) As between party and party, which is the less liberal scale. At any time before the taxing master's certificate is signed any party dissatisfied thereunto may apply to the master to review the taxation, and may also appeal to the judge from such review. [SOLICITOR.]

Taxidermy, the art of preparing and preserving the skins of animals (together with the fur, feathers, or scales), and also of stuffing and mounting them so as to produce a close resemblance to the living form. The skinning, which is carried out with sharp knives, scissors, "pliers," "counter-pliers," and various other implements, is an operation requiring great care, as it is important not to stretch the skin and not to ruffle or stain the fur, plumage, or scales. Various mixtures are used for preserving the skin. One of the commonest is the old-fashioned "arsenical soap," the usual ingredients of which are white soap, salt of tartar, powdered lime, powdered arsenic, and camphor. A good preservative for birds' skins is powdered white arsenic, which may be mixed with powdered alum. For cleaning feathers nothing is superior to powdered plaster of Paris. Of late years much attention has been given to the processes of stuffing and mounting, the best specimens hitherto produced being those at the South Kensington Museum. Success in taxidermy now requires considerable knowledge of anatomy and skill in modelling as well as an acquaintance with technical details.

Taxocrinidæ, a family of Sea-lilies or Crinoidea ranging from the Silurian to the Carboniferous period; the best-known species is *Taxocrinus tuberculatus*, common in Wenlock Limestone at Dudley.

Taxonomy, the scientific classification of animals and plants.

Tay, THE, a Scottish river, rises in Ben Lui, its first tributaries being the Fillan and Dochart, then flows through Loch Tay, which is $14\frac{1}{2}$ miles long, and has in its neighbourhood Ben Lawers (3,984 ft.), and contains a wooded isle with the ruins of a priory, and past Aberfeld, Dunkeld, Perth, and Dundee, the last 25 miles of its course of 118 miles forming a tidal estuary of a width increasing from half a mile to three miles and a quarter, which opens into the North Sea. It is navigable for vessels of 100 tons up to Perth, but has many sandbanks. Among the tributaries are the Tummel, Isla, Almond, and Earn, with their beautiful glens; the river is noted for excellent salmon-fishing.

Taylor, BROOK (1685-1731), mathematician, was born at Edmonton, and educated at Cambridge. He was secretary of the Royal Society 1714-18. His *Methodus Incrementorum Directa et Inversa* (1715) contained the first enunciation of the calculus of finite differences as well as the formula called "Taylor's theorem."

Taylor, SIR HENRY (1800-86), man of letters, was born at Bishop-Middleham, in Durham. Early in life he visited Quebec as a midshipman, and held a post in the Storekeeper-General's office, which he lost through reorganisation. Before his twenty-fourth year he had shown his literary capacity in the *Quarterly Review*. The bent finally given to his genius was in great measure due to the influence of Southey, whose acquaintance he made in 1823. In 1824 he became a clerk in the Colonial Office, his connection with which lasted till 1872. His principal works are his dramas *Philip van Artevelde* (1834), *Isaac Comnenus* (1827), and *Edwin the Fair*

(1842), which show much dramatic vigour, historical insight, and power of delineating character. His *Autobiography* appeared in 1885.

Taylor, ISAAC (1787-1865), man of letters and mechanic, was born at Lavenham, in Suffolk. His father was Independent minister at Ongar, and here he spent the greater part of his life. His best-known works are *The Natural History of Enthusiasm* (1829), *The Natural History of Fanaticism* (1833), and *Spiritual Despotism* (1835). His sister JANE (1783-1824) was the authoress of the *Contributions of Q. Q. Hymns for Infant Minds* was the joint work of Jane and another sister ANN (1782-1866). ISAAC TAYLOR (b. 1829), son of the elder Isaac, was educated at Trinity College, Cambridge, and entered the Church. He has published *Words and Places* (1864), *The Alphabet* (1883), *The Origin of the Argans* (1890), and other works on ethnology and language.

Taylor, JEREMY (1613-67), one of the greatest of Anglican divines and preachers, was born at Cambridge. His father, a barber, was descended from the martyr Rowland Taylor. He was educated at the Perse Grammar School and Caius College, and soon after his ordination attracted the attention of Archbishop Laud, through whom he obtained a fellowship at All Souls', Oxford (1636). He soon afterwards became chaplain to the king, and in 1638 was presented to the rectory of Uppingham. On the sequestration of his living in 1642 he joined the king at Oxford. During the succeeding years he appears to have sometimes accompanied the royal army, but in 1646 he set up a school at Newton Hall, in Carmarthenshire. He here enjoyed the friendship and protection of Richard Vaughan, Earl of Carberry, in whose mansion, Golden Grove, he wrote several of his works. In 1658 his patron obtained him a lectureship at Lisburn, in Ireland. At the Restoration he became Bishop of Down and Connor, and in 1661 of Dro-more also. His most important works were *The Liberty of Prophesying* (1647), *The Life of Christ, or the Great Exemplar* (1650), *The Rule and Exercises of Holy Living* (1650), and *Holy Dying* (1651), which have ever held the first place among manuals of devotion, and the *Ductor Dubitantium* (1660), a handbook of Christian casuistry. Jeremy Taylor's chief characteristics as a writer are his rich eloquence, the majesty of his style, and his deep sympathy both with human and external nature. His intellect was subtle, but he exercised it rather on practical questions of conduct than on abstruse points of metaphysical theology. In regard to dogmatics he held that it was impossible to lay down any certain rule, except on certain essential points of faith, but that considerable scope should be left to the individual mind. Yet, in spite of the breadth of view in these matters which he shows in *The Liberty of Prophesying*, he was a strenuous supporter of Laud on the question of ecclesiastical discipline.

Taylor, JOHN, the "Water Poet" (1580-1654), was born at Gloucester. He took part in the expedition to Cadiz under Essex (1596), and on his

return became a waterman on the Thames. When the Civil War broke out, Taylor, who was an ardent royalist, set up a public-house at Oxford. He afterwards transferred his business to London. His boisterous but vulgar wit is more conspicuous in his prose writings than in his verse.

Taylor, ROWLAND (d. 1555), divine and martyr, was born at Rothbury, in Northumberland, and educated at Cambridge. He became chaplain to Archbishop Cranmer, who presented him to the rectory of Hadleigh, in Suffolk. After two trials before Gardiner, he was burnt at the stake near Hadleigh.

Taylor, WILLIAM, "OF NORWICH" (1765-1836), was the son of an Unitarian merchant. His *Historic Survey of German Poetry, interspersed with Translations* (1828-30) did much to familiarise English readers with German literature. It forms the subject of an essay by Carlyle in the *Edinburgh Review* (1831).

Taylor, ZACHARY (1784-1850), twelfth President of the United States, was born in Orange county, Virginia. He entered the army in 1808, and rendered eminent services in the war with the Indians which followed. As commander in the south-west in 1846, he was ordered to occupy the part of Texas claimed by Mexico, and thus brought about the Mexican War. Its chief feature was the crushing defeat inflicted by Taylor at Buena Vista on a force four times as strong as his own (February, 1847). The "rough-and-ready" general was now so popular that he was chosen as Whig candidate for the Presidency, and was elected, but he only survived his inauguration four months.

Tchaikovsky, PETER I. (1840-1893), Russian composer, was the author of several operas (of which *Eugeny Onegin* is the best-known), symphonies, songs, and chamber works.

Tchamar, low-caste aborigines of India, numerous especially in the North-West Provinces, in Panjáb, Bengal, Malva, Bandelkand, and Gondwana, and numbering altogether over 12,000,000. Although officially free, they still remain practically slaves or serfs, bound to the soil in the rural districts, confined to separate quarters in the towns, everywhere despised and condemned to the lowest pursuits by long-established custom more powerful in India than legal enactments. Some, however, such as the so-called Satnami of Chattisgarh, have been partly emancipated since the first half of the present century.

Tea, one of the most important of food-adjuncts, now in daily use probably by half the human race, is an infusion of the leaves of the camelliaceous evergreen shrub *Thea assamica* and its Chinese cultivated form *T. sinensis*, of which there are two distinct races, *T. Bohea* and *T. viridis*. *T. assamica* reaches twenty feet in height in the shade of the moist jungles of Assam, where it is indigenous; and has smooth, thick, leathery leaves, sometimes over nine inches long, dotted with translucent oil-glands, and having

in their mesophyll, or inner cellular tissue, sphaerophides and large branching thick-walled cells or idioblasts. *Thea* differs from *Camellia* in having its solitary white flowers directed slightly downwards, each having five persistent sepals with bracts below them, five to nine petals, as many inner or free stamens, and only three carpels, each forming a one-seeded chamber to the ovary, with a distinct style. The cultivated Chinese shrubs are only three to five feet high, much branched, with numerous leaves, not exceeding four inches in length. When young the leaves are densely hairy beneath. *T. viridis*, the more northern variety, has larger, brighter-green leaves, and is hardier, than *T. Bohea*.

Tea (Chinese *cha*, pronounced *tay* at Amoy) was certainly used in China in the 6th century A.D., having traditionally been introduced from India by a missionary. From China its cultivation spread in the 13th century to Japan; but the substance was unknown in Europe previous to 1517, and the habit of tea-drinking was not brought westward till the Dutch established themselves at Bantam early in the 17th century. Until 1677 England was entirely supplied from Java, the price ranging from £10 to 15s. per lb. Thomas Garway, founder of Garraway's Coffee-house, in 1660 offered it for sale at prices ranging from 50s. to 15s. In 1660 a duty of 8d. per gallon was imposed on the sale of the infusion, and in 1689 one of 5s. per lb. and 5 per cent. of the value on leaf-tea. The East India Company bought tea first in Madras and Surat and afterwards at Amoy, and the high duties, coupled with their monopoly, led to much smuggling, adulteration, and manufacture of imitation tea. At the close of the 17th century about 20,000 lbs. were imported annually, the price averaging 16s. per lb., and the amount of duty-paid tea consumed in this country rose, in spite of heavy taxation, from less than 1½ million lbs. in 1728 to over 10 million in 1784, over 20 million in 1795, and over 30 million in 1833. The consumption of tea in the United Kingdom in 1840 exceeded 1 lb. per head of the population; in 1860 it exceeded 2½ lbs.; in 1880, 4 lbs.; and at the present time it exceeds 5 lbs. per head, the same proportion as in China, where the total annual consumption has been estimated at 2,000 million lbs. Our total import was nearly 207 million lbs. in 1880, and nearly 225 million lbs. in 1890, 194 million of the latter being for home consumption. The United States consume 1½ lb. per head; Holland, less than a lb.; Russia, less than ½ lb.; but the Australian colonies nearly 10 lbs. per head. More than half our supply is now derived from India and Ceylon, though the cultivation of tea in Assam practically dates from 1840, and in Ceylon from 1876. Tea-planting has also been successfully established in Natal.

The tea-plant requires a deep, friable, moist, but well-drained soil, and a warm, equable, moist climate; and cheap labour is an essential to success in the industry. The leaves are picked so as not to injure their axillary buds, and the younger the leaves on the "flush" or shoot the better the quality. A tree will yield ½ lb. per annum, which will amount to from 300 to 350 lbs. per acre. In

making black tea, the picked leaves are *withered* until limp; *rolled*, generally by hand; *fermented*: exposed, if possible, to the sun for an hour; and immediately *fired*, or dried by hot air or charcoal fumes. Green tea is made in other districts, but from the same varieties, by sweating, softening, and rolling fresh unwithered leaves, repeating this rolling, and heating considerably. Chinese green tea is artificially coloured; but that from India is not. Indigo, Prussian blue, French chalk, and turmeric are the chief materials used for *facing* green tea, the most spurious concoctions being known to the Chinese as *lie tea*. The chief commercial varieties of tea are *pekoe*, *souchong*, *congou*, and *bohea* among black teas, and *gunpowder*, *hyson*, and *caper* among green teas, "pekoe" denoting the white hairs of the youngest leaves. *Brick tea*, a coarse compressed variety, is used almost exclusively in Central Asia, where it is often eaten as a vegetable with milk and fat. Tea contains from .4 to 1 per cent. of a fragrant, narcotic essential oil; from 1 to 3 per cent. of the white, crystalline alkaloid *theine* ($C_8H_{10}N_4O_2$), identical with caffeine and allied to theobromine, and from 12 to 18 per cent. of tannin, Chinese teas being richer in theine and poorer in tannin than those of India. Unless infused in boiling water, neither the theine nor the tannin is properly extracted. Ten minutes' infusion extracts all the theine and essential oil, upon which the tea depends for its stimulating effect upon the brain and the respiratory system. More prolonged stewing only extracts more of the indigestible tannin. Tea has little nutritive value, apart from the sugar and milk often taken with it: in excess it induces nervous irritability and insomnia; but, in the words of Lo Yu, who wrote before 900 A.D., "it tempers the spirits and harmonises the mind, dispels lassitude and relieves fatigue, awakens thought and prevents drowsiness, lightens or refreshes the body, and clears the perceptive faculties."

Teak, the name in the Dravidian languages for the valuable timber-tree, *Tectona grandis*. It belongs to the order Verbenaceæ, and is a native of India south of $25\frac{1}{2}^\circ$ N. latitude (though cultivated in Assam as far north as 27°), of Burma, Java, and the Philippines. It thrives best on low hills, well drained, with an annual temperature of 75° to 81° F., and a rainfall of over 50 inches; and is associated with bamboos. It reaches 100 to 150 feet in height and 25 feet in girth, and has large opposite deciduous leaves and terminal panicles of small white flowers, succeeded by hairy nuts enclosed in accrescent calyces. The timber is yellow, but darkens in seasoning to brown: its annual rings are well marked by the larger and more numerous vessels in the spring-wood: it contains a considerable quantity of an aromatic oil, to which its great durability is due: when once seasoned, it does not shrink or split: it is not very hard, but is easily worked and takes a fine polish; and weighs from 38 to 46 lb. per cubic foot, *i.e.* about 50 cubic feet to the ton. Being heavier than water when green, the trees in Burma are *girdled* or cut through to the heartwood for a year or two before felling, and they can then be floated down the Salwin

or Irrawaddy to Moulmein or Rangoon, down the Menam or Mekhong. The heartwood is not attacked by termites or fungi, and is invaluable as a backing for armour-plated ships, and in India for house-building, railway carriages, parquet floors, and furniture. Our imports vary from 30,000 to 40,000 loads per annum.

Teal, any duck of the genus *Querquedula*, with seventeen species, universally distributed. They are the smallest of the family. The Common Teal (*Q. crecca*), about 14 inches long, breeds freely in the northern and eastern counties of England, and throughout Scotland and Ireland. The Garganey (*Q. circia*), a somewhat larger bird, breeds in East Anglia.

Tealia, one of the best-known and most handsome of British Sea-anemones. The commonest species is *Tealia crassicornis* (Müll.), which is about 2 inches high and 3 inches in diameter, and has about 80 conical tentacles. The colour varies greatly; red dotted with orange or green is a common variety.

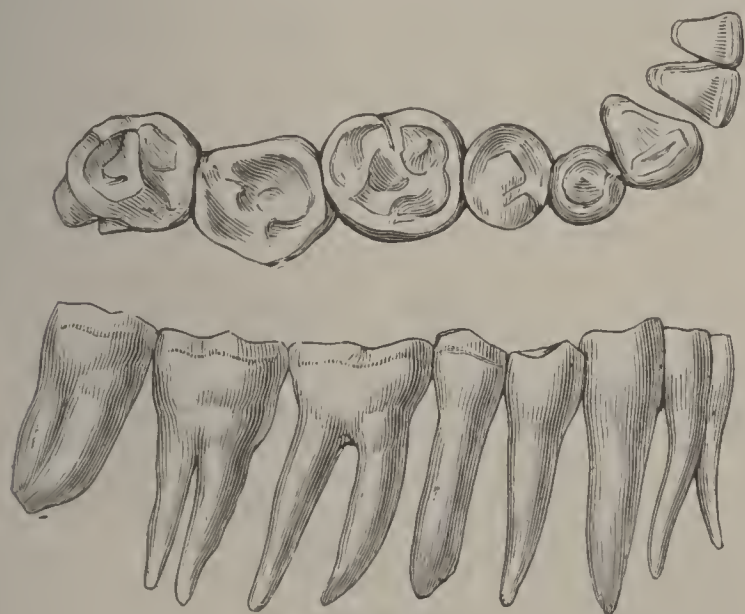
Teazle (*Dipsacus*), a small genus of prickly biennial plants, natives of Europe and Northern Asia, which give their name to the gamopetalous order Dipsaceæ. The opposite cauline leaves in some species are connate, holding rain-water. The flowers are in globular or oblong capitula, opening both centrifugally and centripetally, and each flower is furnished with an involucl of long prickly scales. *D. fullonum*, the fuller's teazle, cultivated in France, Austria, and to some extent in the West of England, is, perhaps, only a variety of the wild British species *D. sylvestris*, from which it differs in its recurved involucl-scales. These scales are just sufficiently rigid and just sufficiently elastic to raise an even pile on cloth, and the heads are consequently fixed in rows in a frame to form part of the fuller's gig-mill or dressing-machine, no wire-cards yet introduced having proved equally effective. We import about 20 millions yearly.

Teck, FRANCIS PAUL, DUKE AND PRINCE OF (b. 1837), is the son of Duke Albert of Würtemberg. In 1866 he married Princess Mary Adelaide of Cambridge. Their daughter, Princess May, was married to the Duke of York, July 6, 1893.

Te Deum Laudamus, or TE DEUM, an ancient Latin hymn which has always been sung at least once a week throughout the Western Church. The tradition that it was composed by St. Ambrose and St. Augustine on the occasion of the latter's baptism appears to have no authentic foundation. From the manner in which it is mentioned in the "rules of Cæsarius of Arles," who was consecrated bishop in 502, it is thought it must have been written before the middle of the 5th century; but, as it contains quotations from the Vulgate, it cannot—at least in its present form—be older than the days of Jerome (d. 420).

Teeth. A tooth consists of the crown (that is, the portion which projects above the gums), the

neck (the somewhat constricted portion of the tooth below the crown enveloped by the gums), and the fang or fangs. On making a section of a tooth, the crown is found to be covered by an outer coating of a very hard substance called enamel; the fang is found to be similarly covered externally by a bony substance, known as the *crusta petrosa* or cement; the body of the tooth beneath these external coverings is made up of a substance known as dentine, and this encloses a centrally-situated cavity—the pulp-cavity—which contains the highly-sensitive pulp of the tooth, supplied by blood-vessels and nerves, which obtain access to it through an aperture at the extremity of the fang. In the human subject the temporary or milk teeth are 20 in number, each lateral division of each of the jaws containing two incisors, one canine and two molar teeth. The order of appearance of these milk teeth is as follows:—The more centrally-situated incisor appears at about the seventh month, the lateral incisor a month or two later, the anterior molar at the twelfth month, the canine at the end of about eighteen

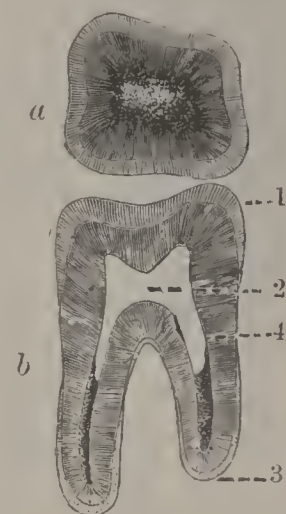


TEETH.

months, and the posterior molar about the end of the second year. As a rule, the teeth of the lower jaw shortly precede in their appearance the corresponding teeth in the upper jaw. The permanent teeth are 32 in number, each lateral half of each jaw containing two incisors, a canine, two bicuspid or premolars, which replace the temporary molars, and three true molars. The first of the permanent teeth to appear is the anterior true molar, which is cut about the sixth year; the central incisor, the lateral incisor, and the two premolars then appear at intervals of about a year each; the canine is cut about the twelfth year, the second true molar a little later, and the third permanent molar or wisdom tooth appears from about the eighteenth to the twenty-fourth year. The permanent teeth are developed in the jaw behind the temporary teeth, which they ultimately displace; and at the age of five years the germs of all the permanent teeth, except the four wisdom teeth, exist ready formed in the jaw of the child, which thus possesses, up to the time when the first milk tooth is shed, no

fewer than 48 teeth—viz. 20 milk teeth and the germs of 28 permanent teeth.

Diseases of the Teeth. Dental caries consists in a gradual eating away of the substance of the teeth, which is probably in great part due to the growth of micro-organisms, and which ultimately leads to encroachment on the pulp-cavity. When this occurs, the tooth becomes tender and sensitive to changes of temperature, and, after a time, exposure of the pulp with severe toothache supervenes. Inflammatory changes in the pulp itself are then apt to occur, leading to the formation of alveolar abscess. Sometimes the periosteum covering the fangs of the teeth becomes inflamed, and alveolar abscess is set up without previous exposure of the pulp. A common name applied to alveolar abscess is gum-boil (q.v.). In the treatment of the diseases of the teeth it is most important to obtain the advice of the dentist from the outset, in order that the mischief may be dealt with before the structure of the tooth is so disorganised as to necessitate its extraction. Temporary relief of the pain, produced by inflammation about the root of a tooth, is often obtained by painting the gum with tincture of iodine; and when a cavity exists and the pulp of the tooth is exposed, a small pledget of cotton-wool, upon which one or two drops of creosote have been placed, may be inserted into the cavity, with a view to relieving the toothache until advice can be procured. In view of the suffering entailed by neglect of the teeth, the desirability of the regular and systematic use of the tooth-brush, especially by children, cannot be too strongly insisted upon.



TEETH.

a, Transverse section;
b, Vertical section
of a human molar
tooth, showing (1)
enamel, (2) pulp
cavity, (3) cement,
(4) dentine.

Tegner, ESAIAS (1782–1846), Swedish poet of peasant extraction, was the son of a pastor at Kyrkerud, in Wennland. He was educated at the university of Lund, where he became professor of Greek in 1812. In 1824 he was appointed Bishop of Wexiö. His principal poems are *Frithjof's Saga* (1820–25); *Axiel*, a romance (1821); and the idyll of *Natvräddsbarnen* (Longfellow's *Children of the Lord's Supper*) (1820).

Teheran, the capital of Persia, lies to the S. of the Elbourz Mountains, which rise in the neighbourhood to a height of 20,000 feet, and 70 miles S. of the Caspian Sea. The old fortifications, four miles in circumference, have given place to boulevards; and the new fortifications, entered by twelve gates, are ten miles round. The N. side has some fine streets and buildings. The Shah has a magnificent palace in the citadel, and there are many country houses on the mountain slopes. The city has good bazaars, gas, trams, telegraphs, and six miles of railway.

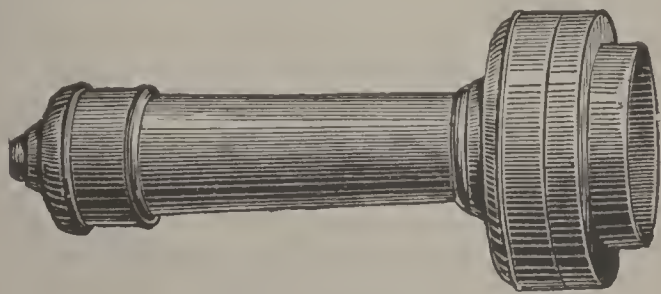
Telegraph, in a general sense, means any apparatus for conveying intelligence to a distance by means of signals, but although systems of signalling by flags, guns, semaphores, etc., may properly be designated telegraphy, yet the term is to a large extent restricted to methods depending upon the use of electric currents. The fact that an electric charge communicated to one end of a wire could be made to produce a visible signal at the other suggested the idea of an electric telegraph in 1753, but it was not until the principles of electro-magnetism were to some extent understood that any practical device was produced. The deflection of a magnetised needle by a coil conveying a current was proposed by many, and developed by Cook and Wheatstone. Six needles and as many wires were at one time used, but these were reduced to one; and the single-needle instrument so developed is still employed to a large extent for railway purposes. Another type of instrument, depending upon the temporary attraction of an electromagnet for its armature, was invented by Morse in America in 1835, and this, having received many improvements in detail, is now generally employed for land telegraphs. In 1840 Wheatstone devised his "step-by-step" or A B C instrument (now superseded), which formed the basis of the type-printing instrument used for distributing items of news. A telegraph system consists of a "line" or wire connected at each end to suitable transmitting and receiving apparatus. In the case of land lines, the wire may be suspended in the air from poles or may be drawn into underground pipes. A single wire only is used to connect each pair of stations, the earth serving for a return conductor, and hence it follows that the line must be insulated as perfectly as possible from the earth. The wire—generally of galvanised iron—is therefore supported upon insulators of vitrified and glazed porcelain, shaped in such a way that some part may be as far as possible protected from wet and dust. Underground wires are of copper, covered with a coating of guttapercha, protected by a lapping of tarred tape, and are drawn into iron pipes placed under the pavements. In a submarine cable a strand of small copper wires is used, and is very carefully covered with several layers of guttapercha. It is mechanically protected by being lapped with jute yarn, and is armoured with spirally-laid galvanised steel wires, the armouring of the parts near the shore being much heavier than that of the deep-sea portion. As a source of electricity, galvanic batteries [BATTERIES] (Daniell's, Fuller's, etc.) are generally used, but in large offices, where the work is heavy, secondary batteries (q.v.) are being introduced, and are found more economical and reliable. The transmitting instrument consists of some form of key (q.v.), which reverses or interrupts the current in accordance with the motions of the operator's hand; and when a message is not being sent, the key must make such contacts that a current from the distant station flows to the receiving instrument. Of the many possible forms of the latter the Morse "Sounder" and "Recorder" are most generally used for land lines. The sounder consists of an

electromagnet, with an armature attached to a pivoted brass lever, normally held against a stop by a spring. One end of the magnet winding is connected to "line" through the key, the other to "earth." When a current is received from the line, the armature is attracted, and, by coming into contact with a stop, makes a sharp click; and on the cessation of this current it is pulled away by its spring and, striking another stop, makes another click. If the key at the sending end is only depressed for an instant, these clicks will follow in quick succession; but if the operator holds down the key for a slightly longer time, there will be an interval between the two sounds. The recorder is similarly constructed, but the pivoted lever is prolonged and carries at its end a small wheel, whose edge is kept wet with ink by means of a roller. A strip of paper is moved over this wheel (but not in contact with it) by a clockwork mechanism, and when the armature is attracted by the magnet the wheel is lifted and touches the paper. A mark is thus made, and the length of this mark depends upon the length of time during which the armature is attracted—that is to say, upon the time during which the sender depressed his key. If he just closes the circuit and immediately opens it, the result will be a very short mark or "dot," or he may make a longer mark or "dash;" and it is by various combinations of dots and dashes that various letters are indicated. The sounder, of course, makes no visible signal, but the difference between a dot and a dash is easily perceived by the ear. The single-needle instrument is a special form of galvanometer (q.v.) with a vertical needle. If the sending operator, by means of a reversing key, puts the positive terminal of his battery to line, the distant needle will be deflected, say, to the right; if he puts the negative to line, the needle will deflect to the left. If a deflection to one side is regarded as equivalent to a dot, and a reverse deflection to a dash, the system of signals or "Morse code" mentioned above can be used. This instrument is convenient in many ways, but in regard to speed it is much inferior to the Morse, and in the case of lines joining large towns speed is a matter of great importance. With the Morse recorder the speed is limited by the quickness with which the operator can move his fingers, and in order to send the greatest possible number of messages over a single line Wheatstone's automatic system is often used. Here an automatic transmitter is used instead of a key. By means of a special machine holes are punched in a strip of paper, the position of these holes depending upon the signal to be sent, and this strip is drawn by clockwork through the transmitting instrument. Certain pins are arranged to be able to pass through the holes in the strip, and by so doing make the contacts needed for sending the message. A number of operators may, at the same time, be punching strips which are successively sent through the same instrument, and by this means as many as 400 words a minute may be transmitted over one wire. Much more delicate receiving apparatus is needed for submarine work than for use on land lines. Thomson's mirror galvanometer was

originally employed for this purpose, being used in the same way as a single-needle instrument, but it has now been generally superseded by his siphon recorder. In the latter instrument the moving part is a small light coil of fine wire suspended between the poles of a powerful magnet, and connected with the circuit. A current in this coil will cause it to deflect to one side or the other, according to its direction, the arrangement being, in fact, a form of electric motor. [DYNAMO.] This coil is connected by silk threads to a siphon of fine glass tube, which, as the coil deflects, is moved over the surface of a strip of paper propelled by clockwork. One end of the siphon dips into a pot of ink, and, either by electrifying this ink or by causing the paper and siphon to be continuously vibrated, the ink is made to come from the far end of the tube in a succession of fine drops. A line is thus made on the moving paper, which wanders to one side or the other of its middle position when a positive or negative current comes from the cable, and this line is read in the same way as are the deflections of a single-needle instrument.

Telemachus, son of Odysseus or Ulysses (q.v.) and Penelope, was born shortly before his father's departure for Troy. On reaching manhood he set out to seek his father, instigated thereto by Athene, who appeared to him in disguise. After his return home he found his father disguised as a beggar, and took part with him in slaying Penelope's suitors.

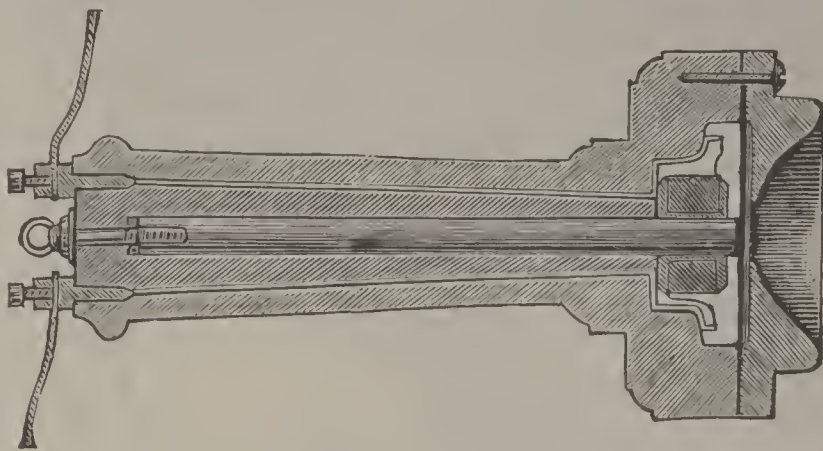
Telephone is an instrument for transmitting sounds to a distance. Sounds directed upon a diaphragm or stretched membrane cause the latter to vibrate, and if a second diaphragm is connected with the first by means of a tight string or wire attached to the centre of each, the vibrations of one will be communicated to the other. Although speech may be transmitted in this way to a limited distance, the difficulty of guiding the string round corners without interfering with its vibrations renders the arrangement of small importance. It appears to have first occurred to Philip Reis to endeavour to make the vibrations of the one diaphragm produce corresponding changes in an electric current, and to make this varying current



BELL'S TELEPHONE.

produce sounds at the distant end of the circuit. He attached a piece of metal to the centre of a diaphragm of bladder, which made and broke contact with a light spring as the membrane vibrated. It had previously been noted by Page that an electromagnet produces a sound as its circuit is made or broken, and consequently Reis was enabled, by simply leading the intermittent current from his

diaphragm to an electromagnet, to reproduce sounds to some extent. But this device did little more than give a sound having the same pitch as the original, whereas, in order to transmit speech, the *form* of the vibrations must also be retained. In 1874 Bell began to make experiments in the same direction, and ultimately succeeded in devising a practicable telephone. In this instrument the



BELL'S TELEPHONE.

sound impinges upon a diaphragm of thin sheet-iron supported round its edge; behind the diaphragm, and opposite its centre, is a short piece of iron surrounded by a coil of fine wire. This iron core forms the pole piece of a steel magnet, and, as the diaphragm in vibration approaches or recedes from it, the resistance of the magnetic circuit is varied and the number of lines of force which pass through the coil suffer a corresponding change. If now the terminals of this coil are connected to the coil of an exactly similar instrument, a current will be generated in the circuit thus formed which will vary in direction and strength in proportion to the motions of the iron diaphragm. But as this current also circulates in the coil of the second instrument the strength of its magnet will be varied, and its iron diaphragm will be attracted more or less strongly, in accordance with the variation of the current and the motion of the diaphragm of the first instrument. It will thus vibrate in a way which is an almost exact reproduction of that of the transmitting instrument, and any sound will be reproduced with considerable accuracy though with some loss in loudness. In order to overcome this last drawback Reis's transmitter was revived in a modified form by Edison, Hughes, Berliner, and many others. In all these carbon transmitters or microphones the vibrations of a diaphragm are caused to vary the resistance of the circuit, instead of making and breaking it, as Reis's did. Two conductors—either both of carbon, or one of carbon and one of platinum—are placed loosely in contact, and it is found that vibrations communicated to such a contact cause its resistance to vary. By placing a battery in the circuit a current which varies with the sound-vibrations is obtained, and such an arrangement used in conjunction with Bell's instrument as a receiver constitutes the modern telephone. The resistance of a carbon transmitter is not very high, and if placed in series with a long line of wire would form but a small portion of the resistance of the whole circuit; hence even a large variation in the

resistance of the contact would produce a small change in the total resistance, and therefore in the current. It is consequently found better to connect the microphone and battery, not to the line, but to the primary winding of a small induction coil (the resistance of which is low), and to connect the line to the secondary winding. In this way a fairly strong current in the primary circuit is converted into a current of much higher potential, suited to overcome the line resistance. In a telephone exchange system wires from each subscriber's

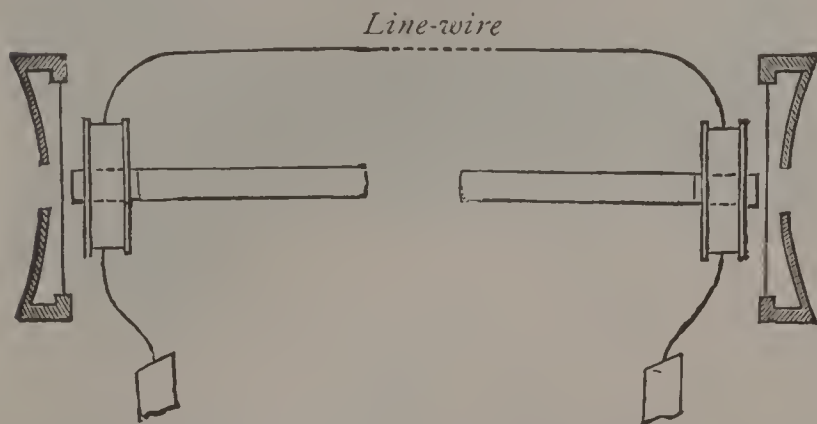


DIAGRAM OF TRANSMITTER AND RECEIVER.

instrument are taken to a central office or exchange, and arrangements are made for connecting any subscriber with any other. This system is further extended by connecting the exchanges in various towns by trunk lines. In the first telephone systems erected, single lines, with earth returns, were used, and from this many troubles have arisen. If a telegraph wire runs parallel and near to a telephone wire, the currents in the former induce currents in the latter, and various return currents are apt to get mixed; further, messages may get from one wire to another by induction or leakage, and the efficiency of the telephone service is very much reduced. The remedy for these evils is to use a second wire as a return, and in places liable to induction, to cross the wires at certain points, so that the average distance of the two wires from the source of disturbance is the same.

Telescope (from two Greek words meaning *to view afar*) is employed as a means of enabling us to see magnified images of very distant and apparently minute objects. Telescopes may be divided into two classes: (1) those in which the first image is produced by a lens—these are known as refracting telescopes; (2) those in which this image is produced by a concave mirror—these are known as reflecting telescopes.

The simplest of the refracting instruments is the astronomical telescope. This consists of a convex lens or object-glass O , and a convex eye-piece E . If a very distant object ACB be viewed through this telescope, each point in it will send parallel rays to the lens O . The parallel rays from A will converge to the point a , and those from B will converge to b . A real inverted image acb will thus be formed of the object AB , and this image will be at the principal focus of the object-glass. The image acb can now be considered as the object viewed by the lens E , and if E be adjusted so that its distance from ab is rather less than its own focal length, a

virtual image $a'c'b'$ will be formed larger than acb , and farther away from the lens. This enlarged image will be viewed by the eye placed behind E . In the diagram (Fig. 1), to avoid confusion, only those rays are drawn which are parallel to the axis and are sent out by the point c in the object. The dotted lines indicate that the rays do not actually pass through c' , but only appear to come from that direction. The distance between the two lenses is almost exactly the sum of their focal lengths, and the magnifying power is their ratio. In practice the lenses are mounted in tubes, and may be brought nearer together or farther apart to suit the convenience of the observer, and to be adjustable for viewing terrestrial objects, which are not, of course, always equally far off. The size of the object-glass determines the amount of light which shall enter the eye, and this must be so great in order to get a sufficient illumination of a very large image that it practically fixes a limit to the amount of magnification obtainable, or at least introduces enormous difficulties in the way of obtaining extremely high magnification.

In astronomical observations the inversion of the image is not of any importance; but when terrestrial objects are viewed it is not, as a rule, desirable to see them upside down. To avoid this, two equal convex lenses are often placed between ab and E ; this reinverts the image which is seen through E , so that the final virtual result is erect. Other arrangements may be used instead of the convex lenses to produce the same effect.

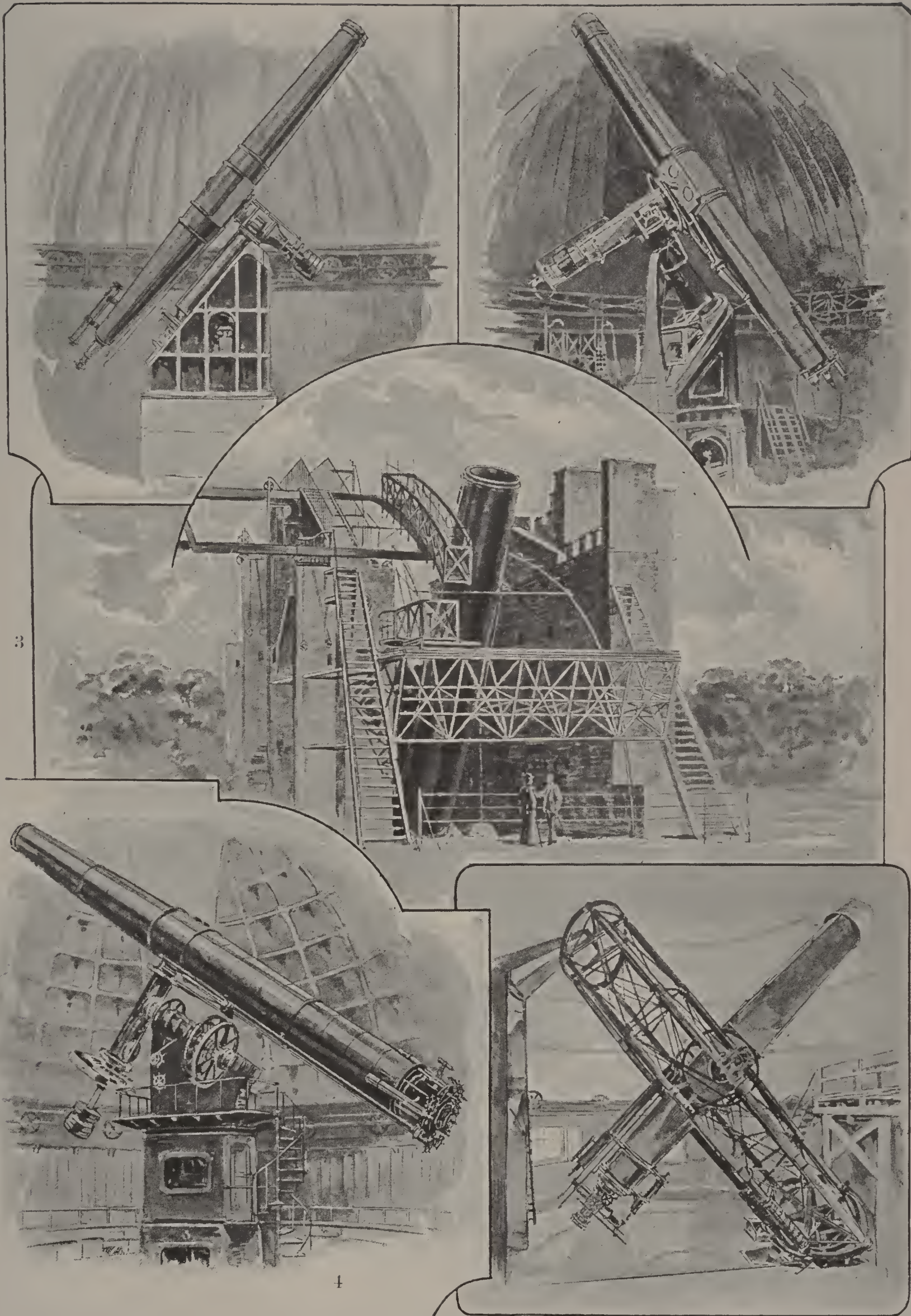
In the Galilean telescope inversion of the image is avoided by the substitution of a concave for the convex eye-piece.

Rays from the object would, after passing through the object-glass O , naturally form the real inverted image ab ; the rays are, however, confronted on their way by the lens E placed at a distance rather more than its focal length from ab , which makes them more divergent. The outer ray ab is bent upwards into the eye, to which it appears to have come from a point b' , while the ray $O E$ is turned so that it seems to have come from a' . The virtual image $a'b'$ is therefore erect. The magnification, as before, is the ratio of the focal length of the object-glass to that of the eye-piece, while the distance between the two lenses is the *difference* of their focal lengths. This makes it a much more convenient size for ordinary use, and hence opera and field-glasses are constructed on this principle, they being, in fact, merely a pair of Galilean telescopes. It is usual to make both object and eye-piece achromatic by using compound lenses, the component parts being of different kinds of glass. [LENS.]

The Galilean telescope could not be used for measuring the exact position of an object, for cross lines would be ineffective, since there is no *real* image formed with which they could coincide.

In reflecting telescopes, the convex object-glass is replaced by a large concave mirror or speculum, which forms the image to be viewed by the eye-piece.

In Newton's telescope, rays from a distant object AB are reflected from the concave mirror S , and



TELESCOPES.

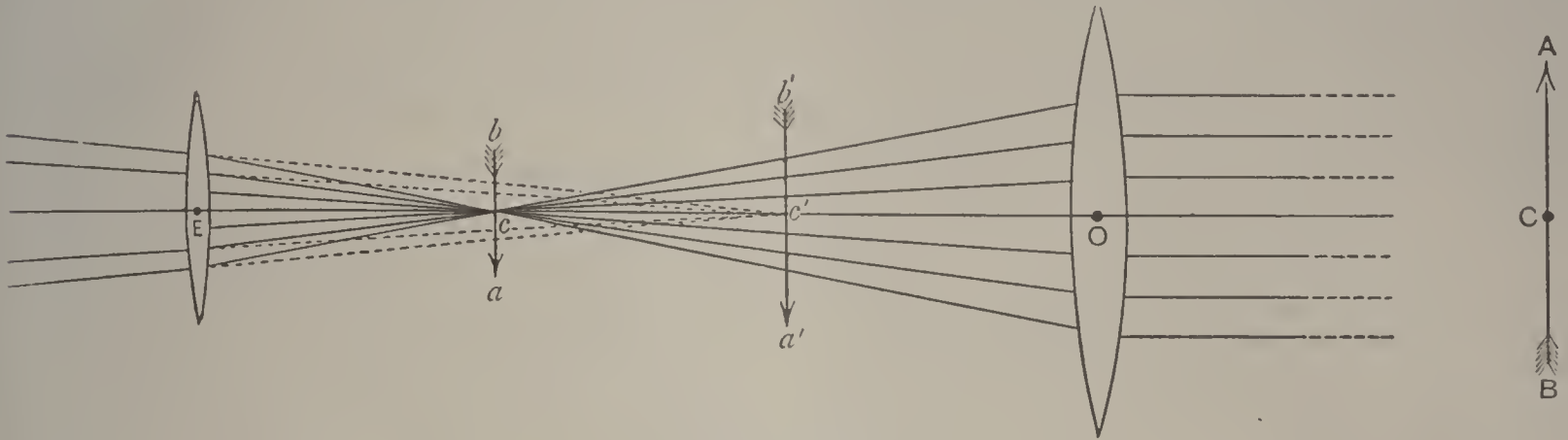
1 Dunsink Observatory Telescope. 2 Vienna Observatory Telescope. 3 Lord Rosse's Telescope. 4 Lick Observatory Telescope. 5 Greenwich Observatory Telescope.

would form a real inverted image at ab ; these rays are, however, reflected by a plane mirror M placed across their path, so that the image is formed at $a'b'$ instead. Viewed by an eye-piece E , this last image appears magnified at $a''b''$. The magnifying power is expressed by the ratio between the focal lengths of speculum and eye-piece.

In the Gregorian—the first reflecting telescope to be invented—the speculum contains a circular

Most telescopes are provided with a compound eye-piece, the usual form being that invented by Huyghens. This consists of two convex lenses, the focal length of the one farthest from the eye being three times that of the other, while the distance between the two is the difference of their focal lengths.

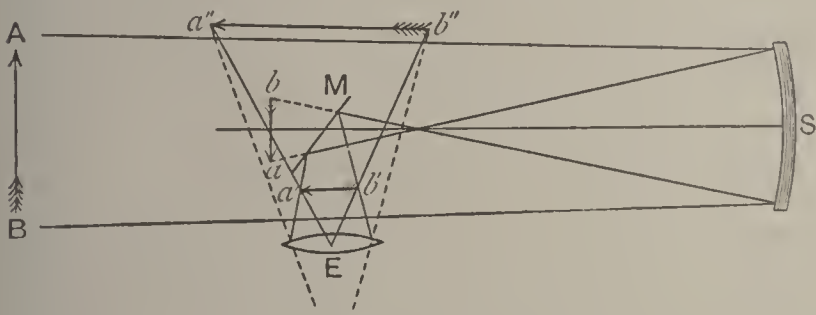
Achromatic refracting telescopes give much brighter and more distinct images than are obtained



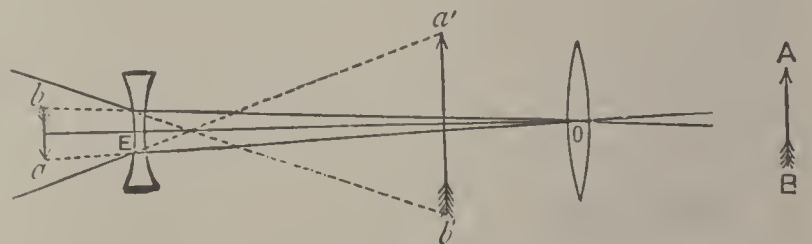
TELESCOPE (Fig. 1).

hole in its centre; it forms a real image in the same position as ab in the Newtonian telescope. A second but small concave mirror, suspended in the centre of the tube, with its back to the light, forms a second real image in front of itself. This image, being the inversion of the first, is erect with regard to the object. The second mirror is so placed that the second image falls near the aperture in the centre of the speculum; an eye-piece placed behind the hole is then used as a means of magnifying it again. The magnifying power is approximately equal to the ratio between the square of the focal

from similar reflectors, but the difficulties in the way of making large object-glasses are enormous. The necessary thickness of the lens makes it very liable to have stresses and strains set up inside it, so that the path of some of the rays is distorted and the image is blurred. Specula, on the other hand, can be made enormously big; Lord Herschell's, in fact, was so large that he could directly view with an eye-piece the real image formed by it. His face was thus turned directly towards the speculum, the fact that his head was in the path of the initial rays not causing any serious interference.



NEWTON'S TELESCOPE.



GALILEAN TELESCOPE.

length of the speculum to the product of focal lengths of small mirror and eye-piece.

Cassegrain's differs from Gregory's telescope in that the first image ab is not actually formed; the rays are intercepted by a convex mirror, which forms an image, as before, near the aperture in the speculum, and this is viewed by a similar eye-piece. The distance of this convex mirror from the position which ab would occupy is rather less than its focal length. The approximate magnifying power is expressed by the same ratio as that which held for Gregory's. This telescope has the advantage of being shorter than Gregory's and of partially correcting spherical aberration [ABERRATION]; but for terrestrial observation it is not so convenient, since it gives an inverted image of the object.

The famous reflecting telescope of Lord Rosse, erected in 1844, has an aperture of 72 inches, while that of the largest refractor—that in the Lick Observatory [LICK OBSERVATORY]—measures 36 inches. The refracting telescope at Greenwich has an aperture of 28 inches.

Telford, THOMAS (1757–1834), civil engineer, was the son of a shepherd in Eskdale, Dumfriesshire. He was apprenticed to a stonemason, and removed to Edinburgh in 1780, and to London in 1782. In 1787 he became surveyor of public works for Shropshire. His chief works are the Ellesmere Canal (1793–1805), the Caledonian Canal (opened in 1823), the road from London to Holyhead (completed in 1815), the Menai Suspension Bridge (1819–26), and the St. Katherine's Docks in London (1826–28).

Tell, WILLIAM, a legendary Swiss patriot, whose story is thus given in the revised version (1734-36) of the *Chronicle* of Ægidius Tschudi (1505-72):—On November 7, 1307, representatives from the forest cantons of Schwyz, Uri, and Unterwalden, exasperated by the Austrian tyranny, had met together on the Rütli Meadow and fixed a day for a general rising. Each leader was attended by ten companions, Tell being present among those from Uri. The most overbearing of Albert II.'s *vogte*, or bailiffs, was Gryssler or Gessler, who dwelt in the castle of Küssnacht, at the north extremity of the Lake of Lucerne. This official fixed the ducal hat of Austria on a pole in the market-place of Altorf, threatening punishment to all passers-by who failed to salute it. Tell and his little son disobeyed the mandate, and were condemned to death; but a hope of escape was held out to them if the father, a noted archer, could hit an apple placed on his boy's head. Having accomplished this feat (November 18), Tell had the boldness to confess to Gessler that if his son had been killed the bailiff would have perished also. Thereupon he was seized by Gessler and carried off in a boat to his castle; but on the way a terrible storm arose, and Tell, the strongest man of the party, was placed at the helm. He steered the boat to a ledge of rock known afterwards as Telles Platte, and, springing ashore, slew the tyrant with his cross-bow. Hastening back to Uri, he stirred up his countrymen, and on the appointed day the rising took place, leading to a war which ended in the formation of the Swiss Confederation. The story of the apple is first found in a ballad, the earlier portion of which was probably written about 1470. The subsequent events were taken from the *Chronicle* of Melchior Russ, of Lucerne, written in 1482 and the following years. Ulrich Freudenberger (1712-70) was the first who detected the similarity of the story to a Danish myth. It is now known that the main incident is found both in Indo-Germanic and non-Aryan folk-lore, and antiquarian research has shown that there is no ground for believing that the chief actors in the drama are historical persons.

Tellinacea, a group of Lamellibranchiata (q.v.), includes those forms with two adductor muscles (those by which the two valves of the shell are closed), a single pair of gills, long separate siphons, and a large foot. *Tellina*—the type genus—is common on our shores, and ranges in time from the Cretaceous period onward.

Tellurium—Te = 125—is a non-metallic element which occurs naturally both combined and in the free state, but only in very small quantities. The chief localities where the element is found are California, Hungary, and Brazil, and its chief compounds are its combinations with the metals silver, gold, and bismuth. When obtained pure, it is a white metal-like substance, which may be obtained in crystals of the Hexagonal system. It melts at about 500°, and distils at a higher temperature. It possesses a specific gravity of about 6.25. If heated strongly in air, it burns with a blue flame, and forms an oxide, TeO₂, which comes off as thick white fumes. The element is insoluble in acids,

except strong sulphuric acid, in which it dissolves to a deep-red solution. Chemically it resembles in many particulars the non-metals sulphur and selenium (q.v.). Thus it forms a hydride, TeH₂, possessing a very disagreeable odour closely resembling that of sulphuretted hydrogen. It forms two oxides—a dioxide, TeO₂, and a trioxide, TeO₃—both of which combine with bases to form salts, the *tellurites* and *tellurates*. The lower oxide also possesses basic properties itself, forming unstable salts with strong acids. The tellurates are for the most part insoluble, many of them being remarkable as existing in two modifications which differ in colour, solubility, and other physical properties.

Telpherage is a form of light electric railway devised by Fleeming Jenkin. A single wire, suspended in the air on posts, supports a series of pendant trucks, whose framework is bent so as to bring the centre of gravity of the load under the wire. This train is propelled by an electro-motor, a current being conducted to it by the line wire by a variety of ingenious devices. Such a line was erected some years ago at Glynde, in Sussex, but the system does not as yet seem to have proved a practical success.

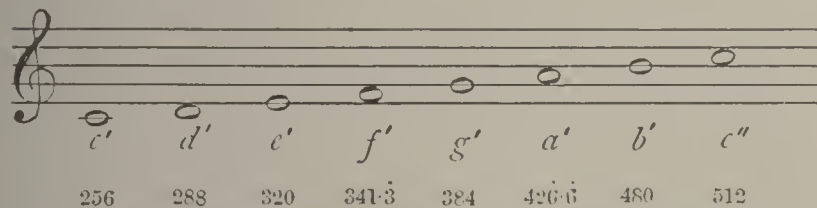
Telugu, the largest division of the Dravidian race, Southern India [DRAVIDIANS], whose domain comprises the Northern Circars, parts of Mysore and of the Nizam's territory, and the eastern seaboard generally from about the parallel of Madras to Orissa, with total population (1891) about 29,000,000. They are also numerous in Singapore, Penang, and other parts of Malaysia, where all the Hindu immigrants from India are commonly called *Alings*, a contracted form of Telinga or Kalinga, as the Telugus are called by their neighbours of Sanskritic speech. They are the "Gentooes," i.e. Gentiles, of the early Portuguese and English writers. Their copious and soft language, the "Italian of the East," has long been cultivated under Hindu influences, and the Telugu translations of the great Sanskrit epic poems date from the 12th century. The Telugu literature is also rich in original works, chiefly poetry, myths, proverbs, and tales. It employs a variety of the Grandonic Alphabet, more fully developed and of rounder form than the Tamil (q.v.). From the fact that Sanskrit writers call the Telugu language *Andhra*, Indian scholars have identified the Telugu people with Ptolemy's *Andræ Indi* dominant in the ancient kingdom of Telingana in Central and East India. (C. P. Brown, *Gram. of the Telugu Language*.)

Temesvar, a city of South Hungary, is upon the Bega Canal, 160 miles S.E. of Pesth. The town proper contains a fortified citadel, and there are four suburbs; and among the chief buildings are a cathedral, castle, and bishop's palace. The principal productions are flour, tobacco, cloth, silk, paper, leather, wool, and oil; and there is a considerable trade in grain, wax, honey, and brandy from Servia, Transylvania, and Roumania. In 1849 the Hungarian rebels besieged it for more than three months, General Haynau eventually relieving it.

Temnechinus is an interesting genus of Sea-urchins or Echinoidea (q.v.), belonging to the family *Temnopleuridae*. The shell or test has numerous grooves or pits along the sutures; but, as these are only "false pits," the genus belongs to the sub-family *Glyphocyphinae*. Specimens of the genus are common in the Crag deposits of Suffolk, where two species occur; one of these is found also in beds of the same age in Belgium, and a living species occurs in the Azores and West Indies. In addition to its distribution, the genus is interesting as one of the few Sea-urchins which are viviparous and do not pass through a metamorphosis. The young are protected in "marsupial pouches."

Temnopleuridæ, a family of Sea-urchins belonging to the order Diadematoidea, and including those forms which have the mouth situated on the centre of the lower surface, and the anus opposite it; the mouth is armed with jaws, and along the sutures between the plates of the test are numerous pits or grooves. The former occur in the sub-family *Temnopleurinae*, and the latter in the *Glyphocyphinae*. The family is now widely distributed, includes twenty-two genera, and ranges from the Cretaceous period onward.

Temperament. A vocalist singing a simple diatonic major scale will produce notes whose vibration frequencies bear a definite fixed relation to each other, independent of the key-note. These frequencies are proportional to the numbers 24, 27, 30, 32, 36, 40, 45, 48. Thus, if we take the middle *c* (*c'*) as our keynote and accept 256 as its number of vibrations per second [PITCH], we shall have the following scale—



Then will follow the octaves of these notes, thus *d''* = 576, *e''* = 640, *f''* = 682.6, *g''* = 768, etc. This is a naturally tempered scale, and will be produced by the voice or the violin—in fact, in any case where the note is controlled by the ear. A singer will feel that these notes are the correct ones in such a key, that they are perfectly in tune, and that the whole effect is harmonious. In the same way, if the vocalist produces the scale of *g'*, starting from *g'* = 384, the vibration frequencies will be

<i>g'</i>	<i>a'</i>	<i>b'</i>	<i>c''</i>	<i>d''</i>	<i>e''</i>	<i>f''</i>	<i>g''</i>
384	432	480	512	576	640	720	768

So long as the notes are entirely made by the producer, as in the case of an unaccompanied singer, no difficulty will arise from the fact that the *a'* is not the same in each scale. But when we are dealing with an instrument whose notes are already formed the case is different. If we gave each scale in turn, we should discover that new notes have constantly to be introduced, many of them differing not very greatly from those already

obtained, but sufficiently so to produce an unpleasant effect on a good ear when the one is substituted for the other. On an instrument, such as the piano, where the notes are fixed, it would be impossible to have a number sufficient to suit all scales. The natural scale is therefore modified, and intermediate notes are introduced, making thirteen from one note to its octave inclusive. There are hence twelve intervals, and these are made of equal value. The vibrations of any note multiplied by $\sqrt[2]{2}$ give the vibrations of the note immediately following it. Such a scale is known as one of equal temperament. The result is not agreeable to a very refined ear, which can detect the sharpness of the thirds and other differences, but custom has trained most ears into an involuntary acceptance of the tempered note as the true one.

Temperance. The temperance movement may be regarded as a product of the newly-developed tendency to combine in associated efforts for the advancement of social and moral progress that formed a marked characteristic of the first quarter of the nineteenth century. The effects of excessive drinking had been frequently pointed out by earnest-minded doctors and divines, who denounced it as a curse to society, and isolated efforts at reformation were put forth by a few persons who, for diverse reasons, refrained from partaking of intoxicating liquors; but it was not until 1826 that an organised movement for the suppression of intemperance was commenced in the United States, where it spread with remarkable rapidity, and gained a firm hold of the sympathies of the people. Intelligence of the new movement reached Great Britain in 1828, and in the following year temperance societies were formed simultaneously in Scotland and Ireland by enthusiastic converts, who were at the time totally ignorant of each other's proceedings. The first English temperance society was formed in 1830 at Bradford, Yorkshire, by a commercial traveller who had attended a meeting in Glasgow, and the same year witnessed the formation of similar societies at Warrington, Liverpool, Manchester, Bristol, and other towns, the agitation being at the same time vigorously carried forward in Scotland and Ireland. Early in 1831 the movement reached the metropolis, where the British and Foreign Temperance Society was formed, chiefly through the earnest and persevering exertions of Mr. William Collins, of Glasgow. All these societies were based upon the principle of abstinence from distilled spirits, with permission to use malt liquors and alcoholic wines in moderation; but their influence upon the public mind was comparatively limited, and it was not until the advantages of teetotalism were promulgated in 1832 at Preston, that anything like enthusiasm was manifested in behalf of temperance reform in England. The leader of the Preston crusade was Mr. Joseph Livesey, who commenced the *Preston Temperance Advocate* in 1834, and after two visits to London succeeded in 1835 in forming "The British Teetotal Temperance Society," which was absorbed in 1836 by the "New British and Foreign

Temperance Society," also a teetotal organisation; and that, after a series of modifications which it would be tedious to describe, eventually developed in 1856 into the National Temperance League, whose headquarters are now in Paternoster Row, London. In the meantime the movement had been spreading throughout the country, and hundreds of local societies came into existence. What is now known as the British Temperance League was formed at Manchester in 1835. The Western Temperance League was founded in 1837; the Scottish Temperance League in 1844; the United Kingdom Alliance in 1853; the United Kingdom Band of Hope Union in 1855; the Midland Temperance League in 1856; the North of England Temperance League in 1858; the Irish Temperance League in 1859; and the Church of England Total Abstinence Society in 1862, its reorganisation under the dual basis taking place in 1873. The Central Sunday Closing Association was reorganised in 1866, and the Independent Order of Good Templars was introduced into England in 1868; whilst the British Medical Temperance Association and the British Women's Temperance Association were instituted in 1876. Other organisations too numerous to mention sprang up from time to time, and swelled the tide of temperance influence throughout the country; the conferences, conventions, and other gatherings being carried on with dauntless vigour and a large share of genuine enthusiasm. The work of Father Mathew—commenced in 1838, and continued for several years—produced a powerful impression not only in Ireland, but in other parts of the kingdom, where, as in America, "Father Mathew" societies are still flourishing. The repeated visits of Mr. John B. Gough, the American lecturer, were the means of securing many fresh adherents amongst all classes, and the persistent labours of other advocates were of inestimable value in enlisting public sympathy, while the extensive circulation of books, pamphlets, and tracts has been of immense service in extending and consolidating an enterprise the success of which largely depends upon the diffusion of reliable information. The latest historical works are Dr. Dawson Burns' *Temperance History* (National Temperance Publication Dépôt) and *The Temperance Movement and its Workers*, by Mr. Winskill (Blackie and Sons); and the *Annual* of the National Temperance League contains a summary of current facts and statistics, compiled from parliamentary papers and other official documents. The weekly organs of the movement include the *Temperance Record* (National Temperance League), the *Temperance Chronicle* (Church of England Temperance Society), the *Alliance News* (United Kingdom Alliance), the *Woman's Signal* (British Women's Temperance Association), the *Good Templars' Watchword*, the *League Journal* (Scottish Temperance League), and the *Scottish Reformer* (Scottish Permissive Bill and Temperance Association); and there are also an immense number of monthly periodicals representing different localities, and dealing with the multiform aspects of the temperance question.

It is easier to describe the progress than to

tabulate the results of the temperance reformation. The national drink bill, large as it is, would undoubtedly have been much larger if no effort had been made to check the growth of drinking habits, and there are many indications that the labours of the early teetotallers have not been entirely in vain. The refusal of an insurance company to accept a proposal from a healthy teetotaler, except at an advanced premium, led to the formation, in 1840, of the United Kingdom Temperance and General Provident Institution, which has demonstrated in a remarkable way the superior longevity of abstainers as compared with moderate drinkers; and the experience of the London Temperance Hospital, established in 1873, conclusively shows that alcohol is rarely necessary in the treatment of disease. The leaders of the medical profession have emphatically declared that "the most perfect health is compatible with total abstinence from intoxicating beverages," and that "alcohol, in whatever form, should be prescribed with as much care as any powerful drug." The Churches, which at first opposed teetotalism, on the ground that it was an unscriptural remedy for intemperance, have gradually come to recognise it as a powerful and indispensable ally, and it is believed that from 50 to 80 per cent. of the Nonconformist ministers in Great Britain are now abstainers, whilst many bishops and clergy of the National Church are to be found in the foremost ranks of earnest temperance reformers. Instruction in temperance matters, encouraged by School Boards and the Education Department, is now a prominent feature in many elementary schools, and the subject is also receiving constant attention in training colleges, universities, and other educational institutions. In the British army a Temperance Association was formed in 1893, under the sanction of the highest military authorities, which received in 1894 a Government grant of £500; and a similar work has been carried on for twenty years in the Royal Navy by the National Temperance League, which has a branch on board every commissioned ship in Her Majesty's service. Temperance men are now found in large numbers in Town and County Councils, School Boards, and other representative public bodies; and the extension of temperance refreshment rooms everywhere shows that the attempts to establish effective rivals to the public-house are warmly appreciated by a large proportion of the general public.

The numerous legislative efforts to diminish intemperance have not yet been attended by much success. The Beer Act of 1830, and the Refreshment Houses and Wine Licenses Act of 1860, although honestly advocated by their promoters as ameliorative measures, have tended to increase and intensify the evil. As early as the year 1834 the House of Commons appointed a Select Committee to investigate "the extent, causes, and consequences of national drunkenness," and a similar Committee was appointed by the House of Lords in 1876, but their elaborate reports did not lead to any practical legislation. A Select Committee on the treatment of habitual drunkards, which was appointed in 1872, prepared the way

for the imperfect Inebriates Act of 1879, which was slightly improved in 1888, but still requires amendment. A Departmental Committee appointed by the Home Office presented a report upon this subject in 1892, when early legislation was promised by the Government. In regard to the Sunday closing of public-houses, more progress has been made. The Scottish Act was passed in 1853; the Irish, exempting six large towns, in 1878; and the Welsh Bill became law in 1881. The Permissive Bill, which was first introduced by Sir Wilfrid Lawson in 1864, was practically adopted by the Government in 1893, when Sir William Harcourt introduced his Liquor Control Bill, providing that public-houses with certain exceptions, may be closed by a local vote of two-thirds of the rate-payers. A great many other measures relating to the liquor traffic have been laid before Parliament during recent years, but none of importance have been passed into law.

Temperature. One of the simplest sensations which we experience is that of heat; but our sense of heat is by no means trustworthy. One person may consider a room to be hot, another may say it is cold, and the same person may regard a body as hot or cold, according to his condition. We can arrange certain bodies of different degrees of hotness in a series so that they form a rising scale, and in this way we are comparing them one with another. This, however, would not be very definite; we should not be able to say *how much* hotter one body was than another. When, however, we have managed to measure the hotness of a body by reference to some standard, we are in a position to speak of its *temperature*. Bodies of different hotness will exchange heat when in each others' presence—the hotter ones cool while the cooler ones get hotter. When no further exchange of heat takes place they are said to be at the same temperature. Thus the temperature of a body can be measured if we know the temperature of another body which is in thermal equilibrium with it. The temperature of this standard body is measured by means of one of the effects which are produced in it by heat. One of the most obvious effects of heat is to cause expansion, and so bodies which expand greatly with heat are chosen as standards of reference. If a bulb of glass containing mercury is connected to a tube of fine uniform bore, the mercury will rise in the tube as it is heated more and more. We might then say that equal differences of temperature shall be taken to mean those which produce equal elongations of the mercury column. An arbitrary scale of temperature would then be obtained. But suppose we took a perfectly different liquid from mercury—say, alcohol—and fixed our scale with reference to its expansion only, we should find the two scales did not agree. If the mercury be taken to expand regularly, then equal differences of temperature measured by it do not produce equal elongations in the column of alcohol. Other liquids show similar variations. Which, then, is to be taken as a true standard? Which is to be considered as expanding regularly? This was a problem of considerable importance, and has only

been satisfactorily settled in modern times. It is found that all perfect gases agree among themselves, and hence the expansion of one of these has been adopted as a standard—*e.g.* in the air thermometer. A perfectly independent scale of temperature has, however, been evolved from thermodynamical reasoning; a scale whose absolute zero (-273° of the Centigrade thermometer) corresponds to that given by the air thermometer, and therefore justifies the trust which had been placed in the latter. [THERMODYNAMICS.]

Tempering of Steel is the process by which tools, etc., are brought to the requisite degree of hardness or temper. The article is first hardened by heating to redness and sudden cooling in water. It is then "let down" by reheating to a lower temperature. The ultimate hardness depends upon the temperature of this second heating, and this is estimated by observing the colour of the film of oxide which forms upon a part brightened for the purpose. The colours and corresponding approximate temperatures for various purposes are as follows:—Pale straw, 430° F., surgical instruments; straw, 460° , tools for brass and wood and penknives, etc.; brown, 500° , scissors, hatchets, saws; purple, 530° , table knives and tools for soft wood; blue, 580° , swords, axes, etc.; deep blue, 590° , watch springs, needles, saws.

Templars. The Knights Templars were a military order founded about 1118 by Hugues de Payen, Geoffroi de St. Omer, and seven other knights, for the protection of pilgrims to Jerusalem and other sacred sites in the Holy Land. They took the vows of chastity, obedience, and poverty before the Patriarch of Jerusalem, and were granted quarters by Baldwin II. in his palace on Mount Moriah, on the site of Solomon's temple, from which the name of the order was derived. At the Council of Troyes in 1128 seventy-two statutes were drawn up, and received the sanction of Pope Honorius II. These enactments formed the foundation of the rule as it was finally settled in the middle of the 13th century. During the first hundred and forty years of its existence the number of knights in the order increased to 20,000, and it became possessed of about 8,000 manors. It was divided into three classes: knights (*armigeri*), chaplains (*clientes*), and men-at-arms (*servientes*). The knights alone were entitled to wear the white linen mantle with a red cross on the left shoulder. The discipline was extremely severe. At the head of the society was the Grand Master, whose place during his absence was filled by the Seneschal, whilst the various provinces in Asia and Europe were under the direction of masters, commanders, or preceptors. A Papal bull of 1172 exempted the Templars from episcopal jurisdiction, and granted them immunity from taxes, tithes, and liability to interdict. The animosity excited against them through this measure was increased by their immense riches, their pride and exclusive spirit, and their constant quarrels with the Knights of St. John. When the Templars betook themselves to Cyprus, after the fall of Acre in 1291, it was felt that their task was ended, and the charges of heresy, immorality, and

impure rites which had been current for some time began to be more boldly circulated. Philip le Bel, the cunning and unscrupulous king of France, perceived that here was an excellent opportunity for recouping his exhausted finances. Jacques de Molai, the Grandmaster, and 140 other Templars were arrested in Paris (1307), and under the tortures inflicted by the Inquisition many of the number confessed to the most horrible charges. Philip was supported, though somewhat reluctantly, by Pope Clement V., who owed his position to the French monarch. Owing to his shifty policy, the inquiries and trials were protracted during four years, ending with the abolition of the order by a bull issued at the Council of Vienne in March, 1312. Two months later their property was handed over to the Order of St. John. Fifty-four knights had already been burned to death in 1310; the remainder were now dealt with by the provincial councils, excepting those of the higher rank, such as the Grandmaster, Jacques de Molai, who was burnt by the king's command, without waiting for the Pope's verdict, in 1314. The order was at the same time suppressed in England, Spain, Portugal, Italy, and elsewhere, but under circumstances of less barbarity than those which attended its dissolution in France.

Temple, the building in which a god is supposed to dwell. The word (Latin *templum*, akin to Greek *temenos*, from the root *tem*, "cut off") originally denoted a sanctuary, but its meaning was afterwards narrowed so as to cover only the edifice erected on a sacred spot. Owing to the connection of the æsthetic impulse with religious sentiment, the development of temple architecture is important in the history of ancient art. [GREEK ARCHITECTURE.] The temple of Solomon possesses a peculiar interest for those who have inherited the religious beliefs of the Jews. In common with most, or at least very many, ancient temples, the *beth elohim* ("house of God") or *hekal* of Jehovah comprised an adytum, inner sanctuary, or "oracle," and an ante-chamber, with an altar before the door of the building. The adytum was a cube of twenty cubits (thirty feet), whilst the ante-chamber measured forty cubits in length, twenty in breadth, and thirty in height; in front of it ran a portico of the same breadth with a depth of ten feet. In the adytum was placed the ark, just as in heathen temples it contained a statue of the deity, or some other token of his presence. As the temple was built by workmen from Tyre, a city far in advance of the Hebrews in the arts of civilisation, it is not surprising that it reproduces many of the features of Tyrian architecture. Thus, the walled court (in Solomon's temple there were two, an inner and an outer), the palm-tree, and the cherub which recur so frequently in the ornamentation of the interior, and the cherubs with outstretched wings which overshadowed the ark, can all be traced to Phœnician sources. The building is supposed to have terminated in a high-pitched gable, with three storeys of small chambers on each side and at the back. There were probably square-headed

windows either above these chambers or in the gable itself. The portico may have been flanked by tall slender turrets, and it is known that there were detached columns of bronze on each side of the entrance (1 Kings vii. 15, *seq.*). The temple of Zerubbabel, completed after constant interruptions in 520 B.C., stood on the site of Solomon's; it was a much less splendid edifice, but the size was probably as large or even larger. The rebuilding of the temple by Herod occupied a period of eighty years (from about 19 B.C. to 63 A.D.). It covered a quadrangular plateau, the area of which, if Josephus may be believed, was twice that of the original structure. He describes it as six stadia in circumference, the Antonia or citadel rising above the general level on the north side. On all sides save the east the sacred enclosure rested on elaborate substructures. Within the outer court, or Court of the Gentiles, which was not holy ground, there was an inner court, divided by a wall into the Court of the Women and the Court of the Men, in the midst of which, at the summit of a flight of twelve steps, stood the sacred building. The space immediately surrounding the temple and altar, known as the Court of the Priests, was separated from the adjoining ground by a low fence of stone. The temple and its precincts were wholly consumed by fire when the city was taken by Titus in 70 A.D.

Temple, FREDERICK (b. 1821), Bishop of London, was educated at Tiverton and Oxford. He was headmaster of Rugby from 1858-68, when he became Bishop of Exeter. In 1885 he was translated to London. He contributed a paper on *The Education of the World to Essays and Reviews* (1860), which, in consequence of the other contents of the volume, roused a futile opposition to his appointment to the see of Exeter.

Temple, SIR WILLIAM (1628-99), statesman, diplomatist, and man of letters, was born in London. His father, SIR JOHN TEMPLE (d. 1677), was Master of the Rolls in Ireland. After studying at Cambridge he travelled in France, Spain, Holland, and Germany, joining his father in Ireland on his return (1654). He sat in the Irish Parliament of 1661, but removed to England in 1663, and two years later was despatched on a secret mission to the Bishop of Münster. His services were rewarded with a baronetcy, and he soon returned to the Continent as English representative at Brussels (1665). In 1668 he negotiated the Triple Alliance between England, Holland, and Sweden, to resist the aggression of France, and a few months later became ambassador at The Hague, but was recalled when his work had already been undone by the secret Treaty of Dover (1670), and was finally dismissed in 1671. After bringing about the Treaty of Westminster (1674), which put an end to the war with the Dutch, he went a second time to The Hague, and took a leading part in the negotiations which resulted in the Treaty of Nimeguen (1678). His diplomatic career closed with his return from the Netherlands in 1679, but he was still an influential politician. At his suggestion Charles II. formed a Privy Council of thirty members on a new

scheme, the real business of which soon fell into the hands of Temple and three others. Disgusted at the king's faithlessness and the venality of politicians, he withdrew to his villa at Sheen, and in 1686 settled at Moor Park in Surrey, where he died. He wrote *Observations on the United Provinces*, two volumes of *Miscellanies*, and *Memoirs*.

Tenant (*tenens* from *tenere*, "to hold"). This word contains a much more extensive idea in the language of the law than it does in its popular sense, where it is used in contradistinction to the term "landlord," and always seems to imply that the land or property is not the tenant's own, but belongs to some other person of whom he immediately owns it; but in the language of the law every possessor of landed property is called a tenant with reference to such property, and this whether such landed property is absolutely his own, or whether he merely holds it under a lease for a certain term of years. The reason of this is that all the real property of this kingdom is by the policy of our laws supposed to be granted by, dependent upon, and holden of, some superior lord in consideration of some service to be rendered to the lord by the tenant or possessor of this property. Tenants are distinguished according to the nature of the estate they hold by appropriate and corresponding terms. Thus a person who holds an estate in fee simple is called a tenant in fee simple; if the estate be an estate tail, he is called a tenant in tail; if for years, a tenant for years; and so on. The word "tenant," therefore, when applied to a person always presupposes such person to be the holder or possessor of an estate of some kind, but of what estate cannot be determined without the additional adjuncts referred to.

Tenasserim, a coast district forming the southern division of Burma, and lying between the Siamese Mountains and the eastern shores of the Bay of Bengal. It contains 46,600 square miles. The capital, Tenasserim, in the S., is 83 miles from the sea; other important towns, Moulmein, in the N., and Tavoy. The district became a British possession in 1825.

Tenby, a municipal borough and watering-place of South Wales, is in Pembrokeshire, on the W side of Carmarthen Bay, 9½ miles E. of Pembroke, and 276 miles W. of London. It is on a headland, beneath which are smooth sands affording an excellent bathing-ground. There is a 13th-century church, with a spire 152 feet high, a fort, and a statue of the late Prince Consort. The ancient walls were strengthened by Queen Elizabeth, and part of the old castle is left. Tenby shares a member of Parliament with Pembroke and some other towns.

Tench, any fish of the genus *Tinca* of the Carp family, with a single species, *T. vulgaris*, frequenting stagnant waters, but more common on the Continent than in Britain. Tench of three feet long are on record, but less than half that size is far above the average. The usual colour is brown with a yellow tinge. The so-called Golden Tench are fish with a tendency to albinism.

Tender. Where a person is ready and willing to pay his creditor he may make what is called in law a tender of the amount. There are certain legal restrictions in so doing, for the money must be actually produced, unless the creditor dispenses with this at the time. The tender must also be unconditional, and for this purpose, in case a receipt is wanted, the debtor should bring a stamped receipt with him, and require the creditor to sign it and to pay the amount of the stamp. Having done this, he is in a position to make a "plea of tender" to any action brought by the creditor. This plea, however, must be accompanied by an actual payment of the amount into court, such payment being alleged in the plea and acknowledged in the margin thereof. The plea amounts in law to an admission of the cause of action.

Tendon, the name given to a structure which serves to connect muscles with bones. Tendons are composed of connective tissue (q.v.); the largest tendon in the body is the tendon in which the muscles of the calf of the leg terminate. [ACHILLES TENDON.] Tendons are sometimes ruptured, and inflammation occasionally occurs within the sheath of a tendon. [WHITLOW.]

Tendrils, a climbing organ produced by the modification of various parts in different flowering-plants. In the vine and Virginian creeper (*Ampelopsis*) the flowers occasionally borne on the tendrils show them to be modified branches. The structural origin of the unbranched tendrils of the cucumbers and passion-flowers is not free from doubt; but those of the vetchling *Lathyrus Aphaca* as clearly represent the whole leaf (except its stipules) as those of the sweet-pea (*L. odoratus*) represent the terminal and some of the lateral leaflets. Darwin suggested that the twisting petioles of *Clematis* and of *Tropaeolum peregrinum* (the "canary-creeper") represent leaves on the way towards becoming petioles. In *Smilax* the stipules are represented by a pair of tendrils, and in the liliaceous *Gloriosa superba* the apex of the leaf forms a tendril. Tendrils perform circumnutatory movements, and they are specially sensitive to contact on the inner surface of their hooked extremities. On penetrating a crevice, or on being pressed against a supporting surface, the end becomes enlarged, so as to become firmly fixed. Circumnutation then causes spiral coiling from either end in opposite directions, with a kink in the middle, thus drawing the climber nearer to its support, whilst at the same time permitting some free play in the wind.

Tenebrionidæ, a family of Beetles including the species *Tenebrio molitor*, the larva of which is well known as the "Meal-worm." This is the common grub found in flour and grain.

Teneriffe, an island, containing a volcanic peak which is the highest point of the Canary Islands. The peak is a dormant volcano, its last period of activity having been in the latter part of the 18th century. It rises to a height of 12,200 feet from a plain—itself 7,000 feet high—of lava and pumice, 8 miles in extent, and surrounded by

precipitous rocks. The peak is covered with forest and meadow in the lower part, but the upper is rugged and barren. There are in reality three peaks, and at the top is a crater 300 feet across, and 70 feet deep. At a height of 11,000 feet is an ice cave. The mount, which has a white appearance, is visible at a distance of 100 miles.

Tenesmus. Under certain conditions, continually repeated and painful efforts to evacuate material from the bowel are made with very little result, the patient being caused to go to stool not so much by reason of the presence of faecal matter in the lower bowel as by the existence of an irritated state of the mucous membrane of the large intestine. This condition, called tenesmus, is a characteristic symptom of dysentery.

Teniers, DAVID, "THE ELDER" (1582-1649), Flemish painter, was born at Antwerp and studied under Rubens. His pictures, for the most part, represent village festivals, groups in taverns, and similar scenes. **DAVID TENIERS, "THE YOUNGER"** (1610-90), son and pupil of the preceding, was appointed President of the Guild of St. Luke, at Antwerp, in 1644. In 1647 he settled in Brussels. He chose the same class of subjects as his father, but greatly excelled him in vivacity and truth to nature.

Tennessee, one of the Central States, U.S.A., is in the valley, and to the west, of the Mississippi, having Virginia and Kentucky on the N., Georgia, Alabama, and Mississippi on the S., North Carolina on the E. The state, which is 385 miles from E. to W., by 109 miles from N. to S., and contains 41,750 square miles, is divided physically into East, Middle, and West Tennessee. The eastern district extends from the Smoky Mountains to the Cumberland plateau, and contains ridges of the Alleghanies, with fine scenery. Between the eastern ridge and the table-land (100 miles) is a valley region extending from N. to S. At the S. of the plateau is a valley, through which the Sequatchie flows to join the river Tennessee. The middle portion, between the North Tennessee river and the Cumberland Mountains, presents a diversified surface. The western part, between the rivers Tennessee and Mississippi, has a ridge, stretching N. and W. and sloping down towards the Mississippi Valley. Among the mineral productions are coal, second only to that of Pennsylvania in quality and quantity, iron-ore, zinc, and marble. The climate generally is good, and the soil fertile, agriculture and stock-raising being among the chief industries. Others are coal- and iron-working, machinery-making; and cotton, tobacco, and hemp are grown. The Cumberland and Tennessee rivers communicate with the Ohio, and there are nearly 3,000 miles of railway. The state has 96 counties, sends 10 members to Congress, and has for principal cities Nashville, Memphis, and Chattanooga. In the Civil War it joined the Confederates.

Tenniel, SIR JOHN (b. 1820), artist, was born in London. He began to contribute to *Punch* in 1851, and, since the death of Leech, in 1864, has been unrivalled as a designer of political cartoons.

Tennis, probably the most ancient of surviving ball-games, is supposed to have been invented in Italy during the Middle Ages, and, after various improvements in France, to have been introduced from the latter country into England, where it had become popular in the days of Chaucer. The rules are very elaborate, the essential feature being that a ball is struck with a racket against one of the walls of a court, so as to rebound on the other side of a net, whence it is returned by the original player's ("server's") opponent, or one of his opponents, if there are more than two players. The ball is thus driven backwards and forwards repeatedly. The scoring is regulated by success or failure in so returning the ball that it falls into a "winning hazard" or does *not* fall into the net or "out of court." There are also intricate rules as to "chases," which arise when a ball is allowed to touch the ground a second time. *Lawn Tennis*, an adaptation of the original game which has become very popular, is said to have been invented by Major Wingfield in 1874.

Tennyson, ALFRED, LORD, was born on the 6th of August, 1809, at Somersby, in Lincolnshire. His family, through the D'Eyncourts, claimed descent from the Plantagenets, and, to the aristocratic feeling thus imparted to the boy, clerical influence was added by both his parents. His father was rector of Somersby and vicar of Grimsby; his mother, Elizabeth Fytche, daughter of the vicar of Louth. He was the third son, and both his elder brothers, Frederick and Charles, became poets. Charles was his companion at the grammar school of Louth, which the two boys quitted in 1820. Their education was then conducted at home, and the freedom which they enjoyed bore fruit in an early devotion to poetry. In 1827 they sold *Poems by Two Brothers* for £10 to a firm of printers in Louth, and in 1828 they proceeded to Trinity College, Cambridge, where Frederick had already gained a university prize for Greek verse. Alfred, in 1829, won the Chancellor's Medal for a prize poem, *Timbuctoo*, the first of such compositions in blank verse, but sought no further distinctions, and left the university without a degree. Among the friends he made at Cambridge were Monckton Milnes, Maurice, and Arthur Hallam, who met in a society called "The Apostles," and, by their fearless discussions, laid down the foundations of a broad faith at the time when the best intellects of Oxford were narrowing themselves into the Tractarian theology. In 1830 Tennyson went with Hallam to the Pyrenees, to carry money and letters to the leaders of a revolt, and published *Poems Chiefly Lyrical*, containing *Isabel*, *Mariana*, etc. In 1833 appeared *Poems*, including *The Lady of Shalott*, *The Miller's Daughter*, and *A Dream of Fair Women*. *The Lover's Tale*, published in the same year, was suppressed, to be republished with its conclusion, *The Golden Supper*, in 1879. In the autumn of 1833 Hallam died, and for the next nine years little is heard of Tennyson, who seems to have lived mainly with his mother, now a widow, and his sisters. In 1842 he brought out a revised edition of his earlier volumes, with some new poems,

Lady Clara Vere de Vere, Morte d'Arthur, The Gardener's Daughter, Locksley Hall, etc. In 1845 he received a Civil List pension of £200 a year, which was the cause of an attack by Bulwer Lytton in *The New Timon*, to which he replied in *Punch* in *The New Timon and the Poets*, and *Afterthought*. He published *The Princess* in 1847, and, in 1850, *In Memoriam*. In this year he married Emily Sellwood, daughter of a solicitor at Horncastle, niece of the Arctic explorer, Sir John Franklin, and sister to the wife of his brother Charles. Shortly after his marriage he was created Poet-Lanreate in succession to Wordsworth. In 1852 he wrote the *Ode on the Death of the Duke of Wellington*, and in the next year settled in the Isle of Wight, at Farringford, near Freshwater. In 1854 he published *The Charge of the Light Brigade*, and in 1855 *Maud*. He helped the Volunteer movement of 1859 with his poem, *The War*, and in the same year made a fresh reputation with the first four *Idylls of the King*, *Enid*, *Virien*, *Elaine*, and *Guinevere*. *Enoch Arden* and *The Northern Farmer (Old Style)* came out in 1864, *The Victim*, *Lucretius*, and *The Northern Farmer (New Style)*, in 1868. At this time the poet was building himself a house, Aldworth, near Haslemere, in Surrey, where he afterwards spent the summer months, returning to the Isle of Wight for the winter. In 1869 he published *The Coming of Arthur*, *Pelleas and Ettarre*, *The Holy Grail*, and *The Passing of Arthur*; in 1871, *The Last Tournament*; and, in 1872, *Gareth and Lynette*. He next turned his attention to the development of the dramatic power, of which he had always shown traces, and produced a succession of plays—*Queen Mary* (1875), *Harold* (1877), *Becket* (1878), *The Falcon* (1879), *The Cup* (1881), *The Promise of May* (1882), and *The Foresters* (1892). Meanwhile, he did not cease to publish poetry. In 1880 he brought out *Ballads and other Poems*, containing *Rizpah*, *The Village Wife*, *Sir John Oldeastle*, etc.; in 1885, *Tiresias*; in 1886, *Locksley Hall*, *Sixty Years After*; in 1889, *Demeter and other Poems*. After he died, in 1892, *The Death of Oenone and other Poems* appeared. Beyond this record of work accomplished, there is little to add as to the life of the poet, who abhorred the custom of making private details public property. He was thrice offered a baronetcy, and in 1884, on the recommendation of Mr. Gladstone, was created Baron Tennyson of Aldworth and Farringford. He died on October 6th, 1892, and was buried in Westminster Abbey. As a thinker, in politics he looked for social progress on conservative lines, and he strove, in philosophy, both before and after the publication of Darwin's work, to interpret the struggle for existence in the light of a broad Christianity. The melody and stately simplicity of his language are unrivalled, and he stands alone as the poet who has been completely successful in various fields—in lyrics of love and war, in broad humour, in epic and dramatic creation.

Tenor, the highest of male chest voices, extending between tenor C and treble A. [VOICE.] The name tenor violin is sometimes given to the viola (q.v.).

Tenotomy, an operation which consists in dividing a tendon, with a view to remedying deformity by allowing the growth of new material between the severed ends. Tenotomy is sometimes practised in the deformity known as club-foot (q.v.)

Tenrec (*Centetes caudatus*), the sole species and the largest known insectivore, being from 12 to 16 inches long. It is a native of Madagascar, Bourbon, and the Mauritius; the body is squat, the snout produced. It feeds on earthworms, and takes a long summer sleep.

Tension is a force which acts equally towards both ends of a stretched string supposed perfectly flexible and inextensible. If a mass hang down by a string, and the whole be at rest, the tension in the string is just sufficient to balance the weight of the mass; it is therefore equal to this weight. When we are dealing with bodies in motion and connected by a string, the value of the tension is not at once apparent. Suppose a mass A resting on a smooth table to be connected to a mass B by means of a string passing over a *frictionless* pulley. Motion will be set up, the string will remain tight, and the two bodies will be equally accelerated. To find the tension T in the string, we may consider the mass A to be acted on by T along the

table; the acceleration of A will therefore be $\frac{T}{A}$, where T is in units of force (poundals), and A in units of mass (pounds). But this same tension is also acting vertically upwards on B, which is further subjected to the downward action of its own weight. The difference between these two is the resultant force acting on B. Its acceleration will therefore be $\frac{Bg - T}{B}$. Since both bodies move

equally, we have

$$\frac{T}{A} = \frac{Bg - T}{B} \text{ or, } BT = ABg - AT \therefore T(A + B) =$$

ABg and $T = \frac{ABg}{A + B}$ poundals, or $\frac{AB}{A + B}$ pounds weight. Thus, if A be 6 lbs. and B 2 lbs., the tension acting throughout the string is $1\frac{1}{2}$ lbs. weight or 48 poundals. When a shaft is driven by means of a belt passing over a pulley, the tension on the receding part of the belt is greater than that in the approaching part. The difference of the tensions in these two portions is one of the factors which determine the power transmitted. This difference cannot be made to exceed a certain limit, which is determined by the condition that the belt shall not slip. It is the fact of friction existing between the belt and the pulley that allows the tension in the one part to exceed that in the other.

Tentaculifera, a class of the unicellular animals known as Protozoa, characterised by the possession of cilia (q.v.) only in the young stage of life. They are usually fixed, are protected by a cuticle or simple kind of shell, and have prehensile tentacles. They are carnivorous, and live either in fresh or salt water. They are divided into two

orders, the Suctoria and Actinaria; the former have suctorial tentacles with or without others, while the latter never have the suctorial appendages.

Tentaculites, an interesting genus of fossils occurring in the Ordovician, Silurian, and Devonian rocks, and the type of the family *Tentaculitidae*. The genus has been assigned to the Pteropoda (q.v.), and regarded as the most typical of all the Palæozoic fossils referred to that class. It seems, however, much more probable that it is a worm-tube from the agreement of its microscopic structure with that of *Cornulites*. In England the best specimens come from the Wenlock Limestone of Dudley.

Tenterden, CHARLES ABBOT, BARON (1762–1832), lawyer, was born at Canterbury. In 1816 he became a puisne judge of the Common Pleas, but during the same year he was transferred to the King's Bench. He was made Lord Chief Justice in 1818, and raised to the peerage in 1827. In 1802 he published the *Law of Merchant Ships and Seamen*.

Tenure signifies the holding of lands or tenements of some superior, and which in feudal times was the leading characteristic of real property. The sovereign, who was at once the source of property and the fountain of justice and honour, had bestowed large territories on the great barons who immediately surrounded the throne, and these again had distributed his bounty through the channels of their numerous dependents. In legal contemplation at least all the landowners of the kingdom thus derived their estates. On this foundation the system known as the feudal system was based—a system which linked every feudatory by a chain more or less extended to the Crown, and rendered his fief ultimately liable to resumption by the sovereign power from which it had, or was assumed to have, originally emanated. The nature of the tenure was characterised by appropriate terms. [FEUDAL SYSTEM.]

Tepyaëks (TEPTERIAKS), a Finno-Tatar people of East Russia, chiefly in the government of Ufa, but also in Orenburg and Perm, numbering (1893) 126,000; appear to be originally Volga Finns, and still speak a Finnish dialect, but the type has been greatly modified by crossings with the surrounding Bashkir and Túrki populations; are now being gradually Russified.

Terbium, a rare metallic element which occurs associated with other rare metals—*e.g.* niobium, erbium, etc., in a few minerals—*e.g.* samarskite. It forms salts corresponding to the oxide Tr_2O_3 , but, owing to its rarity, the chemistry of the metal and its compounds is very incompletely known.

Terburg, GERARD (1608–81), Dutch painter, was born at Zwolle. He became burgomaster of Deventer, where he died. His pictures exhibit contemporary Dutch life in its more refined aspects.

Tercine, the conical papilla upon the placenta of spermatophytic plants which forms the earliest

stage of the ovule (q.v.)—also called the *nucellus*, or, more objectionably, the *nucleus*. Its base becomes elongated into the funicle, and in most cases it is enclosed in succession by the secundine and primine which grow up round it like cups springing from its base (chalaza). From one of its hypodermal cells the embryo-sac (megaspore) originates; and in the ripe seed some of its tissues may survive unabsorbed, as the nutritive *perisperm* (q.v.).

Terebinth (*Pistacia Terebinthus*), also known as the Cyprus Turpentine-tree, is a small resinous tree belonging to the order Anacardiaceæ, and closely allied to the Mastic and the Pistachio (q.v.). It is a native of the Mediterranean area, and has deciduous, imparipinnate leaves, and small round purple fruits. The turpentine is collected from incisions in its trunk, and the curious galls, produced in large numbers on the tree by the punctures of insects, are used in tanning Morocco leather and in dyeing.

Terebratula, one of the best known genera of “Lamp-shells” or Brachiopoda, the type of the family *Terebratulidae*. The animal has a bivalve shell, with one valve much larger than the other, and provided with a beak perforated by a pore through which passes the “peduncle,” that fixes the animal to some support. The shell is smooth, except that it may have one or more broad folds on the margin, and is never marked by ribs as in the *Terebratella*. The support for the gills is short; those forms in which it is long are now separated as the genus *Magellania* (better known as *Waldheimia*), many of the species of which cannot be distinguished from *Terebratula* by external characters. As now limited, the genus ranges from the Devonian to the present time; it is most abundant in the Jurassic and Cretaceous periods.

Teredo, a destructive mollusc known as the “Ship-worm.” Its popular name is derived from the fact that the animal has a long cylindrical worm-like body, and it lives in burrows in wood submerged in the sea. It has no connection with the worms, but is a Lamellibranch, belonging to the group Adesmacia, which also includes *Pholas*. The animal has a pair of long siphons enclosed by the mantle which is in the form of a tube. The shell is small and globular, and is situated at the bottom of the burrow; this is lined by calcareous material. The burrows ramify through the wood, the strength of which is thus ruined. Wood used for piles can be protected against the attacks of the ship-worm by a coating of broad-headed nails, while ships are saved by their copper-sheathing. The *Teredo* is widely distributed in existing seas, and it is known, from the evidence of bored wood, from the Liassic period onward.

Terence. PUBLIUS TERENTIUS AFER (185(?)–159 B.C.), the great Roman comic poet, is supposed to have been born at Carthage and carried to Rome by M. Terentius Lucanus, who gave him a good education and eventually set him at liberty. His *Andria*, *Eunuchus*, *Heauton Timoroumenos*, and *Adelphi* are merely adaptations of plays by the

Greek dramatist Menander, whilst the plot of the *Phormio* is taken from Apollodorus. They depict Greek manners and set up a model of Greek refinement for the imitation of the Roman world. The Latinity of Terence is remarkably pure, and in pathos, wit, dramatic skill, and grasp of character he greatly surpasses Plautus. His graceful manners and literary acquirements gained him the friendship of Lælius and the younger Scipio. He is said to have died in Greece.

Teresa, or THERESA, ST. (1515-82). Spanish mystic, was born at Avila in Old Castile, and in her twentieth year entered a Carmelite convent in her native town. From earliest childhood her religious susceptibility had been remarkable, but she was nearly forty when a vision, in which she beheld blood streaming from the figure on a crucifix, wrought an abiding change in her heart. Her mode of life now became severely ascetic, and from this time she frequently fell into trances, in which she was granted many supernatural tokens of the divine favour. Alarmed at the laxity of discipline in her own and other Carmelite houses, she obtained the Pope's permission to found the order of Descalzos, or Barefooted Carmelites, which was established secretly at Avila in 1562. She was the authoress of an interesting autobiography, and several mystical treatises.

Term was till recently commonly used in two senses: (1) As signifying those four periods of the year during which the Superior Courts sit to hear and determine points of law and transact other legal business of importance (Hilary, Easter, Trinity, and Michaelmas terms). These are now, however, better known as the "sittings" of the courts. (2) Signifying the limitation or extent of time for which a man holds an estate, which is called his term, and he himself is called, with reference to the term he so holds, the tenant of the term.

Tern, a book-name for any bird of a sub-family (Sterninæ) of Gulls distinguished by their small size, long pointed wings, and long and usually forked tail. There are many species universally distributed. From their swift circling flight and their forked tails they are often called Sea-swallows. They feed on small fish and other marine animals, taking their food on the wing. The Common Tern (*Sterna fluvialis*) is British.

Terpenes. A number of compounds are included in the Terpene group, all of which are intimately related chemically, and resemble one another very closely. They are chiefly obtained from the exudations from trees of the order *Coniferae*, from the resins, etc., of which they are derived by distillation. The distillate known as *oil of turpentine* contains a number of the terpenes, all of which possess the composition represented by $C_{10}H_{16}$. It is a mobile liquid, colourless or slightly yellow, which is insoluble in water, and possesses a specific gravity of about .85 to .89. That derived from pine consists chiefly of *pinene*, and boils at about 158°. Other terpenes distinguished as *limonene*, *citrene*, etc., occur in the turpentine of other trees, the most noticeable physical difference

between the various products being in their action on polarised light. They all have agreeable odours and are good solvents for resins, sulphur, caoutchouc, etc. They are on this account largely employed for the manufacture of varnishes, oil-colours, etc. Their constitution has not yet been completely determined, but most appear to be derived from the compound *cymene*, a paramethyl-propyl benzene.

Terraces. [RAISED BEACHES.]

Terra-cotta (Italian "baked earth") properly denotes any object made of baked clay, but in this country the term does not include pottery, but is used only of statuettes, busts, and similar objects, and of the more ornamental clay-work in architecture. Its colour is commonly buff, but sometimes yellow or red. Some of the finest works of classical art and many beautiful products of the Middle Ages and the Renaissance were wrought in terra-cotta. It is now much used in the façades of public buildings.

Terrapin, a general term for the tortoises of the family Chelydidae, used for food in America. They are found in fresh and brackish water, and feed on fish, reptiles and amphibians. The most highly valued is the Diamond-back Terrapin (*Macrolemmys palustris*) found in the salt-marshes along the eastern coast. [TORTOISE.]

Terrestrial Magnetism. [MAGNETISM.]

Terrier, properly a ground-dog, *i.e.* one that follows game into its burrows or earths. The term, however, is now used in a wide sense, and applied to small dogs hunting above ground and to some kept as companions. Besides the breeds specially treated in this book, are the Black-and-tan, and White English terriers, the first-named by far the older, though now the less popular, of the two. The Scotch terrier has a hard stiff coat, and is stoutly built, with short limbs and tail. The Dandie Dinmonts probably have an infusion of bull-dog blood: dark dogs are called "Peppers," and light ones "Mustards," from their prototypes in *Guy Mannering*. The Irish terrier, larger than the Fox-terrier, with a hard, reddish coat, does not go to ground. [BEDLINGTON, BULL-TERRIERS, FOX-TERRIER, SKYE.]

Terry, ELLEN (b. 1848), actress, made her first appearance at the Princess Theatre in 1856. In 1878 she joined the Lyceum company, and was subsequently associated with the chief productions under the management of Mr. Henry Irving (q.v.). Her Shakespearean parts include Ophelia, Portia, Cordelia, Desdemona, Juliet, Beatrice, Lady Macbeth, and Katharine of Aragon.

Tertian Fever. [AGUE.]

Tertiary Rocks. [CAINOZOIC, EOCENE, OLIGOCENE, MIOCENE, PLIOCENE, PLEISTOCENE.]

Tertullianus, QUINTUS SEPTIMIUS FLORENS (*circa* 150-230), the earliest of the Latin fathers, was born at Carthage. He was the son of a Roman centurion, and received a good education in Greek and Latin. The statement of Eusebius

that he became an eminent jurist at Rome is borne out by the forensic style of his works, marked as they are by all the traits, good and bad, which might be expected in a skilful pleader. His conversion to Christianity probably took place between 190 and 195. He became a presbyter at Carthage, but was afterwards led by his ascetic views into the Montanist heresy. In judging of his style, which is often harsh and obscure, it must be remembered that he had before him the hard task of inventing a vocabulary and phraseology in which to express Christian ideas. In spite of these difficulties he is a vigorous, terse, graphic, and often eloquent writer. Among his chief works are the *Liber Apologeticus*, the book *De Præscriptione Hereticorum*, five books *Adversus Marcionem*, and treatises *De Baptismo*, *Ad Martyres*, and *De Corona Militis*.

Test Act, THE (1673), required all persons holding any office under the Crown, whether military or civil, to take the oaths of allegiance and supremacy, receive the sacrament according to the rites of the Church of England, and subscribe the declaration against transubstantiation. It was directed against the Roman Catholics, but was equally effective against Dissenters. A similar Act was passed for Scotland in 1681. These Acts were virtually nullified by an Act of Indemnity which was passed annually. They were repealed on the motion of Lord John Russell in 1828.

Testacellidæ, a family of slugs belonging to the order Stylommatophora (q.v.) and the class Gastropoda (q.v.). The members of the family have a spiral shell of very small size, situated at the hinder end of the body. The shell is thus rudimentary, as it is useless for protection.

Tetanus (LOCK-JAW), a disease in which painful involuntary tonic contractions of the muscles of the body occur. Tetanus is generally traceable to injury with breach of surface of the skin, it is an occasional result of compound fracture, and in rare instances originates from a comparatively simple lesion (*traumatic tetanus*). In some cases no history of a scratch or bruise can be traced (*idiopathic tetanus*). Of late years it has been shown that the cause of the malady is the introduction or growth within the nervous structures of the body of a micro-organism, the bacillus tetani. The first symptoms in the case of traumatic tetanus usually occur after the lapse of 5 or 6 days from the time of injury; they may, however, appear much earlier, and in some instances are delayed till the end of three or four weeks. At the outset the muscles of the jaws or neck are commonly involved, stiff neck or difficulty in masticating or in swallowing being complained of. As time goes on the spasm becomes more pronounced, and extends to other voluntary muscles, and often to the diaphragm, producing difficulty in breathing. Sometimes the spasm is almost confined to the muscles of the jaw, whence the term lock-jaw; usually, however, the spasm is widely distributed. The body may be arched backwards by spasm of the muscles of the back, producing what is called opisthotonos; and in other cases the body is bent

forwards or to one or other side (emprostotonos or pleurosthotonos). The spasm is aggravated, or attacks of spasm may be brought on, by noises, slight muscular efforts, and other trivial disturbances. Tongue-biting is a common symptom; and the contraction, when it involves the muscles of the face, gives the patient a remarkable appearance, to which the term risus sardonius has been applied. The pulse is rapid, sweats are common, the temperature is usually raised, and attains in some instances before death a high degree of elevation. The treatment of tetanus consists in maintaining absolute quiet in a darkened room, and administering chloroform or opium. In some instances division of a nerve above the seat of injury (if such exists) has been resorted to; quite recently a substance has been obtained from the blood of animals affected with tetanus which has been employed as an antidote to the disease in man; there appears some reason for hoping that this may prove efficacious in curing what has hitherto been regarded as an almost necessarily fatal disease.

Tetany, a disease of rare occurrence, which is generally met with in children or young adults, and which is characterised by painful spasm of certain muscles, usually of the hands and fore-arms, sometimes of the feet. The disease is commonly associated with rickets, sometimes with joint affection or laryngismus. The subjects of tetany generally recover from the malady when subjected to a course of tonic treatment.

Tetrabranchiata, an order of Cephalopoda, including the Pearly Nautilus. The characters of the order are that the animal is protected by an external shell composed of many chambers, of which the last is occupied by the body of the animal. The chambers are separated from one another by thin plates or septa, each of which is perforated by a membranous tube known as the siphuncle. In the recent species there are four gills, whence the name of the order. It is probable that the fossil forms had the same number, which may be a relic of an ancestral condition when the organs of the body were repeated in a series, as in the worms. The region of the body around the mouth is divided into lobes, which correspond to the arms of the Dibranchiata, such as the cuttlefish. On the lobes are many tentacles, which correspond to the suckers on the arms of a cuttlefish. The funnel is a mere slit, and not closed as a tube, and there is no ink-bag. The eye is much more primitive in structure than that of the cuttlefish. The Nautilus has a beak-like pair of jaws; and similar structures occur in many fossil forms, and were described as *Rhyncholites* and *Rhynchoteuthis* before their real character was known. The shell in the Nautilus is a discoidal coil, but in fossil forms great variations are known; thus, in some, the coil is not in one plane, but in a spire, as in *Turrilites*, or it may be an open coil, as in *Lytoceras*; in others the shell is not coiled, but cylindrical, as in *Orthoceras*, in which it is straight, or *Cyrtoceras*, in which it is bent, or hook-shaped as in *Hamites*. Most of the Tetrabranchiata are extinct. The order was of great importance in Palæozoic

and Mesozoic times; in the Cainozoic period it is much rarer, and the only living genus is the Pearly Nautilus. There are two sub-orders: the Nautiloidea, of which the Nautilus is the type, and which includes most of the Palæozoic forms, such as the *Orthoceratidae*, and such abnormal types as the *Ascoceratidae*: the second sub-order is the Ammonoidea, which includes most of the Mesozoic species, such as the Ammonites (q.v.), and also some Palæozoic families, such as the *Clymeniidae* and *Goniatitidae*.

Tetracidaris, a genus of Sea-urchins occurring in the Cretaceous rocks of France, which is of importance as having more than two rows of plates in each of the five interambulacral areas. [For terms see ECHINOIDEA.] This character is otherwise only known in the Sea-urchins of the Palæozoic period, which are separated largely on this character as a distinct group.

Tetracoralla, a name originally applied to all corals in which the septa are arranged in 4 or multiples of 4, instead of in 6 or multiples of 6, as in most recent corals. This arrangement has now been abandoned, and the term is used as a synonym of the group of corals known as Rugosa. These corals all have a tetrameral arrangement, but many others with the same character are assigned elsewhere. Thus, the recent *Gugnia* of the West Indies and *Holocystis elegans* of the Lower Greensand are assigned to the *Turbididae* and *Astræidae* respectively; while the Silurian family of the *Stauridae* are now included in the Aporosa. Quelch, indeed, proposed to divide all the Tetracoralla among this order; but this seems to be too radical, and the corals seem worthy of retention in a separate group.

Tetractinellida, an order of Sponges, including those with a skeleton composed of spicules composed of four rays. The spicules may be free, or united by interlocking processes or some intermediate substance; in rare cases the skeleton is absent. The order is also known as the Spiculispongiæ. Most of the members of the group are extinct; but a few, such as *Tethya*, *Geodia*, and *Halisarca*, are still living. It dates from the Silurian period onward.

Tetramera, a section of the Coleoptera or Beetles, including those with four joints in the tarsus or last division of the leg. The great group of the Longicorns and the Weevils are the two best known members.

Teutonic Knights, a military-religious order founded in 1198. The members were bound to tend the sick and wounded and fight the heathen. It was finally suppressed in Germany by Napoleon in 1809. It still exists in Austria.

Teutonic Languages, a main branch of the Aryan linguistic family (q.v.), in which they hold a position somewhat intermediate between the Slav-Lettic and the Italo-Celtic groups, while presenting some special phonetic and structural features which give them an unique place in the family. In this group the organic Aryan mutes undergo two distinct series

of permutations, in accordance with the so-called law of *Lautverschiebung* ("Sound-shifting"), discovered by Rask, developed by Grimm, and completed by Verner. The first series of shifts took place in prehistoric times, and is found already fully carried out in Gothic (q.v.), the oldest known member of the group. In this process the surds or voiceless stops *p*, *k*, *t* first become everywhere the voiceless spirants *f*, *h*, *th*; then these spirants, when medial and in association with sonants, become themselves the sonant or voiced stops *b*, *g*, *d*, always in weak syllables, and also in strong syllables before the accent; but when they follow the accent the second shift is arrested, and they remain voiceless spirants. The influence of the Aryan accent, first noted by Verner, is seen in such examples as Sanskrit *ántara*, Gothic *ánthar*, Anglo-Saxon and English *óther* for *ónther*, with single shift only (*t* to *th*), because the accent precedes; but Sanskrit *antár*, Gothic *undar*, Anglo-Saxon and English *under*, with double shift (*t* through *th* to *d*), because the accent follows. The process extends in Anglo-Saxon and Norse to the organic voiceless spirant *s*, which similarly passes through *z* to *r*, as in Gothic *dius* for *diuz*, Norse *dýr*, Anglo-Saxon *deór*, English *deer*. The second series of shifts is historical, no trace of it occurring in Gothic or in any extant Teutonic forms (geographical or personal names, etc.) before the 7th century. Its later appearance is also shown by the fact that it never spread to the whole of the Teutonic domain, but is mainly confined to the South German highlands, where the process was continued sporadically to about the close of the 11th century. The South German dialects were thus constituted a distinct group under the name of *Hoch-Deutsch* (i.e. "High German") in contradistinction to the *Platt-Deutsch* ("Flat" or "Lowland German") of the northern plains, which were unaffected by the process, and which consequently remain in their phonetics truer representatives of primitive Teutonic speech. The process itself is due to a general tendency to strengthen the mutes, so that the soft sonants (*b*, *g*, *d*) become hard surds (*p*, *k*, *t*), while these become hard (voiceless) spirants (*pf* or *f*, *h* or *ch*, *ts* written *z*). Thus, the *Catti* of the Romans pass through such forms as *Chatti*, *Hatti*, *Hazi*, *Hassi*, to the modern *Hessians*; but the rotation is arrested at the hard spirants *f*, *h*, *th* of the prehistoric series (representing organic *p*, *k*, *t*), because these are incapable of further strengthening. Hence it is that the primitive Teutonic *f* and *h* persist in High German (Greek *κῶν*, Gothic *hunds*, Anglo-Saxon and German *hund*, English *hound*). Surd *th*, however, passes through sonant *th* (*dh*) to *d*, and later further permutations take place (such as *z* to *ss*) in the Hoch Deutsch group, which thus becomes historically differentiated into *Old* (7th to 11th century), *Middle* (12th to 15th century), and *Modern High German*. In general, the dental are much more fully carried out than the labial and guttural shiftings, so that the primitive surd *th* (as in *think*) passes through sonant *th* (as in *then*) to *d* in the Low as well as in the High German group, but not in Anglo-Saxon and English, which thus

stand phonetically on the same high level as Gothic itself—that is, nearest to organic Aryan speech. Hence it is that words like *three* (Gothic *threis*, Anglo-Saxon *threo*), *thorn* (Gothic *thaurnus*, Anglo-Saxon *thorn*), etc., appear both in Low and High German with initial *d*: Dutch *drie*, *doorn*; German *drei*, *dorn*; all representing organic Aryan *t*, as in Sanskrit *tri*, Greek *τρεῖς*, etc. There are traces, however, of the tendency even in Gothic, surd *th* passing once or twice to *d*, just as in English *murther* (Anglo-Saxon *morthor*, Gothic *maurthr*) has become *murder*; as in some dialects *de*, *dey*, *dree* are heard for *the*, *they*, *three*. Other features distinguishing Teutonic from the sister Aryan tongues are:—(1) *Umlaut*, or modification of the root-vowel, a later development, being unknown in Gothic, by which the root-vowels *a*, *o*, *u* and certain diphthongs are modified under the influence of an original *i* or *j*, in the following syllable, to which they tend to be assimilated. The inflecting vowels themselves tend to disappear, thus giving inflecting force to the umlauted vowels, as in Anglo-Saxon *fót*, plural *fet*, from older *foti*, *fote*, *fete* = feet. (2) Great loss of nominal, adjectival, and especially of verbal grammatical forms; the seven organic cases are reduced to four (in English to two), with greatly weakened endings and consequent confusion of the original stem declensions, while of the immensely rich Aryan verb little remains except two tenses (present and past), three moods (indicative, subjunctive, infinitive), and the present and past participles. The middle and passive voices are entirely gone, those of the Norse group being later reconstructions. (3) The evolution of new and very peculiar nominal, adjectival, and verbal processes (the so-called weak as opposed to the organic strong declensions and conjugation), the origin of which is involved in much obscurity. It is noteworthy that all these grammatical peculiarities pervade the whole Teutonic domain, so that the affinities of the several branches are determined, not so much by their inflecting forms as by their phonetic systems. All Teutonic languages must be grouped with one or other of the two main Low and High divisions (*see above*), according as they are or are not affected by the later (historical) series of sound-shiftings, as in the subjoined table:—

LOW GERMAN DIVISION.	GOTHIC	(extinct).
	NORSE	{ W. Branch: Old Norwegian; Icelandic.
		{ E. Branch: Danish; Swedish.
HIGH GERMAN DIVISION.	NIEDERDEUTSCH	{ Frisic.
		{ Netherlandish: Dutch; Flemish.
		{ Continental or Old Saxon.
		{ Anglo-Saxon: English; Scotch.
	MITTELDEUTSCH	{ Frankish (extinct).
		{ Thuringian: Neo-Saxon; Transylvanian.
	OBERDEUTSCH	{ Burgundian: [Swiss.]
		{ Alemannic: [New High German (Literary Standard).] Bavarian: [Tyrolese]; Austrian.

Teutonic Race, a main division of the peoples of Aryan speech [ARYANS], whose domain at the dawn of history (1st century B.C.) comprised nearly the whole of Central Europe between the Elbe and the Rhine, together with all Scandinavia,

except the extreme north and Iceland. This domain has been maintained nearly intact throughout the historic period, and greatly enlarged in various directions from time to time down to the present day. Most of the lands occupied by Teutonic peoples at the fall of the Western Empire—Lombardy, Burgundy, a great part of Gaul, the Iberian Peninsula, and the Roman province of Africa—have since been reoccupied either by the indigenous populations or by later intruders. But permanent additions were made to Teutonic territory by the irruption of Angles, Saxons, Frisians, and others into Britain, by the continuous spread throughout the upper and middle Danube basin (Alsatia, Suabia, Franconia, parts of Helvetia and Rætia, Upper and Lower Austria, parts of Bohemia and Transylvania), by encroachments on the western Slavs and Lithuanians in the Elbe basin, and eastwards to the Vistula (Pomerania, Brandenburg, West and East Prussia, Silesia), by the Norse occupation of Iceland and south-west Finland, and, since the discovery of the New World, by the expansion of the English and others of Teutonic speech throughout nearly the whole of North America, South Africa, and Australasia. Thus a great part of both temperate zones is now held by Teutonic peoples, numbering collectively about 195,000,000, of whom 115,000,000 belong to the Anglo-Saxon branch (English, Scotch, Anglo-Americans, Australasians, South Africans), 63,000,000 to the Germanic (Germans, Austrians, Swiss), 8,000,000 to the Netherlandish (Dutch, Flemings, Boers), and 9,000,000 to the Scandinavian (Danes, Swedes, Norwegians, Icelanders).

When they first became known to the Romans the Teutonic peoples appear to have had no general national name; even the word *Germanus* applied to them collectively was not a native but a Celtic designation, of disputed origin, adopted by the Romans, and from them by the modern English. Later certain groups and confederacies were known as Teutones. Alemanni, Franks, Saxons, Suevi (Swabians), Thuringians, *Boioarii* (Bavarians), etc. Most of these names either remained localised, disappeared, or became obsolete, while two acquired a general signification—*Alemanni* amongst the Romance peoples (whence the French *Allemand*, *Allemagne*, the Spanish *Alemania*, etc.), and *Teutones* amongst the Germani themselves, possibly through association with the Teutoburgensis Saltus (Teutoburger Wald), where Varus and his Roman legions were cut off by Arminius (A.D. 9). The word, being derived from a root meaning “people,” “nation” (*cf.* Gothic *thiuda*; Anglo-Saxon *theod*, as in Oros. i. 11: “Binnan thæm syndon manega theoda, ac hit man hæf eall Germania;” *thiot Traneono* = “nation of the Franks,” etc.), was easily generalised through such adjectival forms as *Theodise*, *Tudesk*, *Diutisk*, *Teutsch*, *Deutsch*, whence the English *Dutch*, which, however, since the 17th century has been restricted to a small section of the race about the Rhine delta. Through long contact and interminglings with the conterminous Celtic, Slav, Lithuanian, and perhaps earlier populations, the noble Germanic type, as known to the Romans and described by Tacitus—tall stature,

florid complexion, blue eyes, flaxen hair, regular features—has almost everywhere undergone profound modifications, and at present is more frequently seen in outlying territories (Great Britain, Scandinavia) than in the primitive Teutonic domain. In fact, the modern descendants of the Germani of Tacitus are not conspicuous for physical beauty in either sex, the bulk of the people being somewhat heavy, coarse-grained, and ill-favoured, though still robust, vigorous, and strong-limbed. But on the intellectual side every branch of the Teutonic race has progressed, and with such names as Shakespeare, Bacon, Milton, Newton, Harvey, Scott, Turner, Faraday, Darwin, Linné, Thorwaldsen, Kepler, Leibnitz, Kant, Goethe, Humboldt, Mozart, Handel, Beethoven, Grimm, stands almost admittedly at the head of modern European culture in its broadest sense.

Tewfik Pacha, MOHAMMED (1852-92), became Khedive of Egypt on the abdication of his father Ismaïl in 1879. His reign was marked by the rebellion of Arabi (1882-83), and the insurrection of the "Mahdi."

Tewkesbury, a market-town of Gloucestershire, is at the junction of the Avon and Severn, 8 miles N.W. of Cheltenham, 10 N.E. of Gloucester, and 15 S.E. of Worcester. The cruciform church, which was formerly a Benedictine abbey, is 317 feet long and 124 feet across the transepts, and has a tower 123 feet high. It was restored in 1875-79, and, while in the main Norman, has Early English, Decorated, and Perpendicular features, the west front being especially notable. The murdered Prince Edward, son of Henry VI., was buried here, and there is a tablet to the author of *John Halifax*. Other buildings are the town hall, exchange, and grammar school, and there is an iron bridge—by Telford—over the Severn. Tewkesbury is the centre of an agricultural district, and was the scene of a battle in 1471 during the Wars of the Roses.

Texas, by far the largest of the United States of America, is in the S.W., and has the Indian Territory on the N., Arkansas and Louisiana on the E., Mexico and the Gulf of Mexico on the S., and New Mexico on the W. Its length and breadth are 900 miles and 700 miles respectively, it has 400 miles of coast-line, and contains over 263,000 square miles. The coast is low and sandy, and the interior consists of prairie, plateau, and mountain. From the mouth of the Sabine river, which separates it from Louisiana, to that of the Rio Grande, which separates it from Mexico, the coast is fringed by low islands and peninsulas, enclosing wide lagoons, and occupied by sand-hills. The longest island is Padre, N. of Rio Grande, and has a length of 100 miles. For several miles inland there is fertile alluvial soil, consisting of fruitful plains alternated by barren tracts covered with cactus and mezquite. The district from Corpus Christi Bay to Rio Grande is called the Desert. Farther inland come well-timbered prairie-lands, and to these succeed bluffs and table-lands rising to the Llano Estacado. There is abundance of

fertile and good grazing land, and corn-growing and cattle-raising are on the increase. The soil, which is greatly various, is best in the S. and S.E., where rain is abundant. The climate of the lowlands on the coast is semi-tropical, tempered by the winds from the Gulf, that of the middle region is dry and healthy, and in the W. it is so dry that meat will dry up without decaying. The whole state is subject to cold storms called "Northers." The chief rivers are the Arkansas and the Red River, flowing to the Mississippi, and the Red, Sabine, Grande, Trinity, Brazos, and Colorado rivers, flowing into the Gulf. Among the minerals are coal, iron, tin, lime, gypsum, salt, and stone. The chief productions are wool, dairy-produce, cotton, wheat, sugar, rice, and fruits, especially the orange. There are ten large towns, Austin, on the Colorado, being the capital. Texas was annexed by the United States of America in 1845.

Texel, an island of North Holland at the entrance of the Zuyder Zee, is separated from the southern mainland by the Maarsdiep. It contains 35,000 acres of pasture and arable land, and is celebrated for its wool and cheese. Naval actions have been fought here by Blake, Van Tromp, De Ruyter, Duncan, and others.

Thackeray, WILLIAM MAKEPEACE, novelist, was born on July 18, 1811, at Calcutta, where his father was employed in the Company's civil service. His mother had been Miss Anne Becher, and, her first husband having died five years after the novelist's birth, she afterwards married Major Carmichael Smyth. Soon after his father's death Thackeray came to England, where he was put under the care of his aunt, Mrs. Ritchie, and when eleven he was sent to Charterhouse school, which figures in so many of his books. In 1829 he went to Trinity College, Cambridge, where he had among his contemporaries and friends Tennyson, Spedding, and Edward Fitzgerald. Leaving the university without taking his degree, he travelled for some time on the Continent, making long stays at Weimar, Rome, and Paris, which latter city always remained one of his favourite haunts. He read for the bar, though apparently not with great energy, and contemplated making painting his profession, but want of success in his work and the loss of a comfortable fortune, through the failure of an Indian bank and the collapse of newspaper speculations, induced him to turn to literature as a means of livelihood. In 1836 he had married Isabella, the daughter of Colonel Shawe (who, becoming insane in 1840, died early in 1894), and his circumstances appear to have been straitened for many years after. All his early work is not known, but he became a regular contributor to *Fraser*, *The New Monthly*, and later on *Punch*, pouring out a vast quantity of sketches, stories, criticisms and poetry, but making no name with the general public. In 1840 he published his first book, *The Paris Sketch Book*, in 1841 *Comic Tales and Sketches*, while in the same year appeared *The Hoggarty Diamond*, *The Shabby Genteel Story*, which was afterward expanded into *Philip, Barry Lyndon*, a work full of powerful sarcasm, and *Men's Wives*. In 1843 he

brought out his diary of a tour in Ireland as *The Irish Sketch Book*, and in 1846 the record of a journey to the East, *From Cornhill to Cairo*. It is not, however, by his early works, clever and able as they often are, that Thackeray has earned a place among great writers, but by his novels, of which the first commenced to come out in monthly parts in 1847 under the title of *Vanity Fair*. This first success, which firmly placed the author in popular favour, was followed by *Pendennis* (1848), *Esmond* (1852), *The Newcomes* (1853), *The Virginians* (1857), *Philip* (1862), and *Denis Dural* (incomplete, 1863). Thackeray paid two visits to the United States, where he was cordially welcomed, in 1852 lecturing on *The English Humorists of the 18th Century*, and in 1855 on *The Four Georges*, the profits of these lectures, which he also delivered in England, placing him in comfortable circumstances. In 1857 he stood as a Liberal for Oxford city, but was beaten by Mr. Cardwell. In 1860 he was appointed the first editor of *The Cornhill*, in the pages of which magazine appeared *The Roundabout Papers*, *Lovel the Widower*, *Philip*, and *Denis Dural*, upon which he was at work when he died suddenly on Christmas Eve, 1863. Of plot there is little in his novels, which are valuable rather for their author's profound insight into human nature, his hatred of all shams and his sympathy with all that is pure and true, his humour and wit, and his limpid style.

Thalamifloræ, one of the two divisions or series into which polypetalous dicotyledons (q.v.) are divided. It is characterised by the hypogynous or thalamifloral insertion of the stamens—*i.e.* by their insertion directly on the thalamus or floral receptacle which has not, as it has in the other division, the Calycifloræ (q.v.), grown out into a disc or tube, the so-called calyx-tube. With hypogynous stamens, the ovary in this division is necessarily superior. The division includes, among others, the large orders Ranunculaceæ, Cruciferae, Violaceæ, Caryophyllaceæ, Guttiferæ, Malvaceæ, Geraniaceæ, and Rutaceæ.

Thalamophora. [FORAMINIFERA.]

Thalberg, SIGISMOND (1812-71), pianist, was born at Geneva, and studied in Vienna under Hummel. His first public performance was at Prince Metternich's in 1826. He earned both fame and riches in his tours through Belgium, Holland, England, and Russia (1839), the United States (1855), and Brazil (1855, 1862). In 1858 he settled at Naples.

Thales (circa 636-546 B.C.), one of the Seven Wise Men of Greece, and founder of the Ionian school of philosophy, was born at Miletus. He taught that all things are modes of water.

Thaliacea, one of the three orders of Ascidiæ (q.v.), including those with barrel-shaped bodies and thin delicate tests or mantles. They are all free-swimming. The most interesting point about the order is that in both families (*Doliolida* and *Salpida*) there is an alternation of generations.

Thallium (Tl = 201), a metallic element which was first discovered by Crookes in 1861, when

examining the spectrum of some dust deposits from sulphuric acid chambers. It has since been shown to be found in many varieties of pyrites, in numerous mineral waters, and a few minerals. The metal itself is very soft, and can be scratched with the finger nail. It may be drawn into wire and beaten into foil. It has a bluish-white colour and is distinctly crystalline, a bar of the metal emitting a peculiar crackling sound if bent. It melts at about 300° C., and readily oxidises, and, if heated sufficiently, may burn with a bright green light. It forms a well-defined series of thallous salts corresponding to the oxide Tl₂O. Of these the chloride is almost insoluble like that of lead, differing, however, in the ready solubility of the sulphate.

Thallophyta, the lowest sub-kingdom of the vegetable world, comprising some plants in which sexual reproduction does not seem to have made its appearance, others in which propagation is direct and not cyclical, and others again in which the alternation of generations, though present, is rendered irregular by the intercalation of various asexually-produced generations or *gonidia*. In the first class, which comprises minute unicellular plants, reproduction consists merely in cell-division. In the second class, comprising many filamentous forms, the gametes conjugate and produce a cell, the *zygospore* or *oospore*, which develops directly into a gametophyte, so that there is no sporophyte or alternation. The name *thallophyte* is taken from the fact that there is very rarely in this sub-kingdom anything like a differentiation of stem and leaf, the whole plant being a *thallus* (q.v.). The thallus may be unicellular, cœnocytic, or multicellular; but the cell-walls, though sometimes thickened or mucilaginous, are never lignified, nor is there any marked differentiation of tissues. Nevertheless, between the simplest Schizomycete and the higher Algæ and Fungi there is an enormous difference in complexity. The most satisfactory subdivision of the sub-kingdom is into the two great groups or classes, the Algæ (q.v.), and the Fungi (q.v.), since the presence of chlorophyll in the former and its absence in the latter is correlated with other characters.

Thallus, a plant body which is either unsegmented, or, if segmented, segmented only into similar members—*i.e.* in some cases branched, but exhibiting no differentiation into root and shoot, or into stem and leaf. Thus among the lower Thallophyta (q.v.), in which there is no alternation of generations, the thallus may be a single spherical cell, or a spherical cœnobium with multilateral symmetry; or it may be filamentous, with or without branches. The thallus of the higher Algæ and Fungi is far more complex; but it is a structure which is represented outside the sub-kingdom Thallophyta, as by the dorsiventral dichotomous gametophyte of most Hepaticæ (q.v.), by fern prothallia, by the archisperm in all spermatophytes, and by the main body of the minute rootless duckweed, *Wolffia arrhiza*.

Thames, THE, takes its rise in the Cotswolds, in Gloucestershire, its early course consisting of

the Leach, Coln, and Churn. In passing Oxford it receives the name of Isis, and becomes the Thames after receiving the Thame at Dorchester. It flows past Reading—where it receives the Kennet—Great Marlow, Maidenhead, Windsor, Staines, Kingston, Richmond, London, Greenwich, Woolwich, and Gravesend, where the estuary begins. The chief tributaries on the left bank are the Windrush, Cherwell, Thame, Coln, Lea, Roding, and the Kennet, Loddon, Wey, Darent, Mole, Waddon. Medway on the right. Its course to the Nore is 250 miles long, or 120 miles in a direct line. At London Bridge the width is 290 yards, at Woolwich 490 yards, at Gravesend 1,200 yards, and at the Nore lightship 6 miles. Of the bridges on its lower course London Bridge is the oldest, and the magnificent bascule Tower Bridge the newest. The part of the river immediately below London Bridge is called the Pool, and that, with the lower portions, constitutes the Port of London. Ships of 800 tons can come up to St. Katherine's Dock, while the lower docks, especially those of Tilbury, will accommodate the largest vessels. The Thames in London has been greatly improved by the Embankments. In its course the Thames separates Oxford, Buckingham, Middlesex, and Essex on the N., from Wilts, Berks, Surrey, and Kent on the S.

Thane (*thegn*), an Anglo-Saxon title, which seems to have originally signified one of mature age, and hence a soldier. Later on it acquired the same meaning as *gesith*, that is, a member of the king's *comitatus* or personal following; but, as the thanes received grants from the royal demesne, the term came to imply the holding of land, and eventually denoted any landowner whose estate exceeded five hides. The king's thegns were those who held directly from the king. After the Conquest many of the thegns passed easily and naturally into the knightly order under the Norman kings.

Thanet, ISLE OF, forming the N.E. corner of Kent, is now an island in name only, being separated from the rest of the county by the Stour, and a brook which represents the ancient Wansum channel. It has the sea on the N. and E., and Pegwell Bay on the S., and its dimensions are 9 miles E. to W., and 5 from N. to S. It contains the well-known watering-places Margate and Ramsgate, and at the North Foreland is a celebrated lighthouse.

Thanet Sands, a series of pale-yellow, or occasionally greenish, sands, forming the base of the Eocene system in the London basin, corresponding to the *sables de Bracheux* of the Paris area, but not represented in Hampshire. They contain some clay partings, and at their base the "Bull-head bed" of green-coated flints resting on the Chalk. In the Isle of Thanet they reach a thickness of 60 feet, but thin away at Sudbury (Suffolk) and Ealing (Middlesex). Though fossils are rare in these beds, some 70 species, mostly marine, have been found, including sharks'-teeth, a nautilus, an oyster and many other pelecypods, and several foraminifera.

Thaumatrope. [ZOETROPE.]

Theatre (Greek *theatron*, "a place for seeing"), a building intended for dramatic representations. Edifices of this kind originated in Greece, the details of their plan being determined by the requirements which arose with the development of the Attic drama. The form ultimately assumed was that of a segment of a circle, the seats of the audience, which ascended the sides of a natural hollow in tiers corresponding to the arc, whilst the stage (*proskenion*) ran along the base. The *koilon* occupied by the spectators had a sweep of somewhat more than a semicircle, the space immediately below them in front of the *proskenion* being the *orchestra*, the most ancient and important part of the whole structure. In its centre stood the altar of Dionysus, round which the chorus sang and danced, recalling the sacred origin of the spectacle. On those rare occasions when they took an active part in the drama, they mounted the flight of steps leading from the *orchestra* to the *proskenion*. Behind the *proskenion* rose the *skene*, a stone wall containing three doors, which communicated with the actors' dressing-rooms. It was usually ornamented with columns and entablatures so as to resemble the front of a palace or temple. If this scene was not suitable, curtains were hung in front of it, or wooden scenery was introduced as a background. Stage devices were largely used, the most celebrated being the *mechane*, by which gods were lowered from the clouds. The most ancient Greek theatre of which there are any remains is that of Dionysus at Athens. The Roman theatres resembled the Greek in most respects, but they were generally built on level ground, and the orchestra was occupied by the seats of senators.

The mysteries and miracle plays of the Middle Ages were performed in churches, monasteries, or temporary booths, with no scenery but a scaffold in three stages to represent heaven, earth, and the infernal regions. A building for secular plays was opened in Paris by the Confraternity of the Passion about 1548, and before the close of the century several theatres modelled on that of Vitruvius had been erected in Italy. Those in which the plays of Shakespeare and his contemporaries were first acted had a more homely origin. The theatre at Shoreditch, built by James Burbage in 1576, preserved all the features of the inn-yards in which the bands of strolling players had been wont to entertain their uncritical audience. The stage was a platform surrounded by the pit or "yard" on all sides but one, where it communicated with the green-room or "tiring-house." The galleries of the inn-yard reappeared in the rows of boxes or "rooms," which ran round the whole area. As regards scenery, with the exception of a few articles of furniture and similar objects, the only aid given to the imagination was a label on which the locality was written. The "Curtain" in Shoreditch was built soon after the "Theatre," which in 1598 was re-erected in Southwark, its name being changed to the "Globe." Under this title it became famous in connection with Shakespeare. Both the "Globe" and the "Swan" (1592), a contemporary drawing of which remains, were octagonal wooden structures, whereas the "Fortune"

(1599-1600) was square. Two important changes were made immediately after the Restoration—the introduction of movable scenery, and the appearance of women in the female parts. At the same time there began a gradual alteration in the internal arrangements, which continued till the middle of the 18th century. The details of construction had by that time become pretty well established, and it has not since been found necessary to introduce many modifications.

By the 6 and 7 Vict., cap. 68, the licensing of theatres became a function of the Lord Chamberlain in London and the immediate vicinity; elsewhere of the justices of the peace. By the Local Government Act of 1888 the place of these authorities was taken by the County Councils, which frequently depute their power to the justices.

Thebaine ($C_{19}H_{23}NO_3$) is an alkaloid which occurs associated with morphine in opium. It forms small plates with a silvery lustre, which melt at 180° . It is insoluble in water, but is readily dissolved by warm alcohol and by acids. In its chemical constitution it is closely allied to morphine (q.v.), which it resembles also in its chemical behaviour, being, however, much more poisonous.

Thebes. 1. Thebes (the “hundred-gated” city of the Greek poet), now in ruins, was once the capital of Upper Egypt, and is still a place of interest to the antiquary and the ethnologist. It is situated in lat. 26° N., in the broadest part of the Nile Valley, upon a broad and cultivated plain. Besides many temples, it contains the “vocal” Memnon and another statue of great interest. The remains of Luxor and Karnak stand opposite Thebes on the eastern side of the Nile. Some of the buildings are said to date from 2500 B.C., and the city's most flourishing period was from 1600 to 1100 B.C., when it took the place of Memphis as capital. Its central position gave it safety. In 1100 Memphis again became the capital, in the 6th century B.C. Cambyzes plundered it, and at a later period it was injured by the rise of Alexandria. In early Christian times its remoteness made it a favourite abode of Christians, and the monks and hermits of the Thebaid were numerous. Of the principal temples one has a statue of the founder, 60 feet high; there are two temples of Amenoph III., a terraced temple of Queen Hatasu, near which some valuable mummies were found, a great temple of Rameses III., with paintings illustrating victories, etc., 17 tombs of the queens, tombs of kings. The temples and other remains at Luxor and Karnak are equally interesting. Charles Kingsley utilises the Thebaid in the early part of *Hypatia*.

2. Thebes, the ancient capital of Bœotia in Greece, was between the Dirce and Ismenus, 44 miles N.W. of Athens. Its Akropolis was called Cadmeia from Cadmus, whom tradition declared to be the founder of the city. Dionysus, Hercules, Amphion, and Tiresias were born here, and it was here that the Greek tragedians found material for the plays that centred around the story of Œdipus. Owing to a quarrel with Athens, Thebes sided with the Spartans in the Peloponnesian War, but afterwards repented, and withdrew from the alliance.

The victories of Epaminondas at Leuctra (371 B.C.) and Mantinea (362 B.C.) gave Thebes a temporary supremacy, but the defeat of Chæronea (338 B.C.) was the beginning of their downfall. After the death of Philip of Macedon the Thebans tried to regain their independence, but Alexander destroyed the city, and sold the inhabitants as slaves.

Theca, a genus of fossils ranging from the Cambrian to the Permian periods, but most characteristic of the former; it is of interest as it is one of the best known of the group regarded as Palæozoic Pteropoda (q.v.). It is, however, very doubtful whether it really belongs to that order, while its correct name is Hyolithes.

Thecaphora, the Zoophytes of the sub-order of Hydroida (q.v.), in which the zooids or individuals of the colony are protected by cups or thecae. The best-known families in it are the *Campanulariidae*, *Sertulariidae*, and *Plumulariidae*, which include many of the best-known of our English Sea-firs. The group is wholly marine; the fossil forms assigned to it are of little interest.

Thecidiidae, a family of Brachiopoda ranging from the Carboniferous period to the present. The members of it are fixed by the beak to some body, while the margin of the shell is much thickened; it thus assumes a form very different to those of most Brachiopoda. One of the most remarkable genera included in the family is the genus *Oldhamina* from the Carboniferous rocks of India.

Theciidae, a family of fossil corals found in the Silurian rocks. Its structure is very abnormal; it is now assigned to the Perforata, and regarded as an ally of the *Favositidae*. The best-known form is *Thecia swindernana* of the Wenlock Limestone.

Thecosomata, the order of Pteropoda (q.v.) which includes those members of this class in which the body is protected by a mantle fold and a shell. It includes three living families, of which the *Hyaleidae* is the best known; the two Palæozoic families of *Conularidae* and *Theciidae* are included here, but it is doubtful whether these are really Pteropods.

Theft (in legal parlance, LARCENY) is the felonious taking and carrying away of the personal goods of anyone from his or her possession with intent to convert them to the use of the offender without the consent of the true owner. Larceny was formerly distinguished into grand and petty larceny, the former including the stealing of goods above the value of 12d., the latter of that value or under. This distinction was abolished by a statute passed in the reign of George IV., and now all larcenies are subject to the same incidents as grand larceny. Larceny is sometimes distinguished as simple and compound, the former being larceny of goods only, the latter larceny from the person or habitation of the owner. The law regarding this offence is now consolidated by the 24 and 25 Vict., ch. 96, which renders also many things (both animate and inanimate) the subjects of larceny, which for several reasons were not so prior to that Act.

Theine. [CAFFEINE.]

Theism, a term applicable to any system of belief which takes as its starting-point the existence of One Personal God. It is thus opposed on different grounds to Atheism (q.v.), Agnosticism (q.v.), Pantheism (q.v.), and Polytheism (q.v.). Theism differs from Deism in that the latter of necessity rejects all revelations lying outside and beyond the course of nature and denies that God sustains the world which He has created, whereas these points either may or may not be included in the creed of a Theist.

Thellusson, PETER (d. 1797), a London merchant, celebrated as having left the bulk of his wealth to accumulate for the benefit of his descendants. An Act was in consequence passed (40 George III., c. 98) which made such bequests illegal.

Themistocles (*circa* 514–449 B.C.), a celebrated Athenian general and statesman. After the ostracism of his rival Aristides (483) he became the foremost man at Athens, and directed his energies to the formation of a powerful fleet, thus laying the foundations of the city's naval supremacy. In the war against Persia the chief command was given to the Spartan Eurybiades, but it was the action of Themistocles in forcing an engagement which led to the naval victory over Xerxes at Salamis (481). When the Persians had been driven out he accomplished the fortification of the city in spite of Spartan opposition; but the unpatriotic faction ultimately prevailed, and in 471 he was ostracised. Expelled from Argos and Corcyra in turn, he at last found a refuge at the court of Artaxerxes, King of Persia, over whom he acquired great influence.

Theobald, LEWIS (*circa* 1688–1744), Shakespearean critic and dramatist, was born at Sittingbourne in Kent. He incurred Pope's hatred by attacking his edition of Shakespeare, and was the original hero of the *Dunciad* (1728). His own edition of Shakespeare, a much more creditable performance than Pope's, was published in 1733.

Theobromine, $C_7H_8N_4O_2$, occurs largely in the cocoa bean (*Theobroma cacao*), from which it may be obtained by boiling with water, adding lead acetate, evaporating, and extracting the residue with alcohol. It forms small crystals of the Rhombic system, which sublime if carefully heated. It has a slightly bitter taste, and dissolves to a small extent in water and alcohol. It forms salts with acids, most of which are, however, decomposed by water. Its constitution is very similar to that of *theine* or *caffeine*, and *xanthine* (q.v.), the compound being dimethyl xanthine, $C_5H_2(CH_3)_2N_4O_2$, while *theine* possesses the constitution of trimethyl xanthine. The chemical deportment of these substances is also, as would be expected, very similar.

Theocritus, the great pastoral poet of Greece, was born at Syracuse in the early part of the 3rd century B.C. All that is known of his life is that he studied at Cos, numbered the poet Aratus and the physicians Nicias and Philinus among his

friends, and passed many years at the court of Ptolemy Philadelphus in Alexandria. In his rural *eidyllia* ("idylls," little pictures) the life of Sicilian shepherds and fishermen is brought before us with a simplicity and freshness which can never lose their charm. Other poems give an equally vivid picture of the life in great towns; a third class deal in epic style with themes derived from the ancient mythology; and to these must be added epigrams, *vers de société*, and courtly addresses to Ptolemy and Hiero. Many of the poems are written in the form of dialogues. They are all in the Doric dialect, and were doubtless suggested by the popular poetry of the age. Virgil, in his *Eclogues*, closely follows Theocritus.

Theodolite is a portable instrument used in land-surveying for measuring horizontal and vertical angles. A telescope is fitted on bearings, so that it can rotate about a horizontal axis at right angles to its optical axis, and a graduated circle is provided for observing the amount of such turning; the uprights which support the telescope are fixed to a circular horizontal plate capable of being rotated on a vertical axis. This plate is also graduated on its edge, and verniers (q.v.) are provided for each circle. The whole is fixed to a tripod stand, and screws and levels are provided to enable the horizontal disc to set truly horizontal. A magnetic compass is also fitted to the horizontal plate. To use the instrument it is levelled, an object is sighted in the telescope, and the reading on the circle is noted; if now another object is sighted and a fresh reading taken, the difference between the two readings gives the angle between lines joining these two objects with the centre of the instrument.

Theodora, the name of several celebrated women of the early ages, of whom, perhaps, the most notable was Theodora who became wife of the Emperor Theophilus and Empress of the East in 830. She was a Christian, and resisted the Iconoclastic movement with all her force. She became regent in 842, while her infamous son, Michael III., was a minor, and ruled with much wisdom and strength. Her son, a monster of iniquity, deposed and imprisoned her in 857. She had subdued several of the savage tribes who threatened her empire, converted several potentates, and placed St. Ignatius on the patriarchal throne of Constantinople. She died in 867, and is considered a saint by the Greek Church.

Theodore, ARCHBISHOP OF CANTERBURY, was born of Christian family about 603 A.D. in Cilicia, and was educated at Tarsus, his native city, becoming distinguished for his acquirements. In 668, whilst at Rome, he was appointed to the See of Canterbury, where he arrived in 669. He is generally credited with having begun the foundation of English scholarship by making the monasteries repositories of classical learning. He deposed Wilfrid in Northumberland, and held two synods in 673 and 680. He was reconciled to Wilfrid and reinstated him before his death, which occurred in 690.

Theodōric the Great, King of the East Goths, was born in 455 at Vienna, and became a dreaded power to the Byzantine Emperors, who had failed to pay a tribute to the East Goths. He gained many important victories, and became the most powerful of all the early Teutonic rulers. He favoured art and learning, and reigned wisely on the whole, dying in 526.

Theodosius the Great, Roman Emperor, was born at Galicia, in Spain, about 346, and entered the army in youth, serving till the death of his father in 376. He was appointed administrator of the Eastern Empire by Gratian about 378, and repelled the Gothic invasion on two occasions. After the revolt of Maximus against Gratian and the death of the latter, he opposed Maximus and finally defeated and killed him, entering Rome in triumph. His ruthless massacre of 7,000 of the inhabitants of Thessalonica, in revenge for the murder of an officer of his, remains the greatest blot on his reign. In 392 he routed the forces of Arbogastes and Eugenius, who had deposed and murdered Valentinian, brother of Gratian, and died shortly after (395). He finally destroyed paganism by merciless penalties, and may be said to have checked the spread of the Arian heresy.

Theognis (570?-485 B.C.), Greek elegiac poet, was born at Megara, and belonged to a family which was the ruling party in his native place. Hence the gaiety of his earlier pieces; but, after the triumph of the democratic party and the confiscation of the property of the aristocrats, his poetry became more mournful in character and took an elegiac turn. He is considered the most remarkable of the Gnostic poets, and was ranked high as a moralist among the ancient Greeks. Only a few fragments of his poems remain. They were first published under the name of *Sentences* by Aldus in Venice in 1495.

Theology, the body of doctrine which treats of the nature of God and the relation between God and man. The term came into use in the Christian Church in connection with the doctrine of the Logos, and was applied especially to St. John. It afterwards acquired a wider signification. Theology is distinguished as either (1) *Natural*, or (2) *Supernatural* or *Positive*. The former is given by the light of nature; the latter comes through a special revelation, at once confirming the truths accessible to the unaided reason, and imparting others which would not otherwise have been known. Apart from this general division, theology comprises various branches, such as (1) *Apologetical Theology*, which is concerned with the evidences of religion and the authenticity of the Scriptures; (2) *Exegetical Theology* or *Hermeneutics*, which aims at interpreting and explaining the Bible; (3) *Dogmatic Theology*, which gives a systematic exposition of the dogmas on which the faith of the Church is built up; and (4) *Polemical Theology*, which defends the doctrines thus established, and refutes heretical views. *Practical Theology* embraces not only Christian ethics, but Pastoral theology (which treats of the intercourse

of the pastor with his flock), and questions concerning Church government and ecclesiastical discipline.

Theophrastus, Greek philosopher, born about 371 B.C. at Eresus in Lesbos. He studied under Plato and Aristotle in Athens, and succeeded the latter as head of the Peripatetic School there. He was an expounder of the Aristotelian philosophy, and wrote various works, many of which are lost. The most notable of his productions is the one entitled *Characters*, an exposure of the follies and vices of mankind, which has been imitated and translated by the eminent French writer La Bruyère (q.v.). Some of his works are botanical, and others deal with metaphysics, etc. An edition was printed in Leipzig in five volumes (1818-21).

Theosophy, a form of religious speculation which consists in assigning attributes and characteristics to the Deity, and showing how the origin and order of the universe are determined by the Divine nature. It cannot be properly regarded as a branch of philosophy, since, in its search for truth, it lays claim to a special revelation, or, at any rate, trusts to an illuminated faith rather than the exercise of the intellect on the material furnished by experience; yet the Theosophist and the transcendental metaphysician have much in common, and the intellectual career of Schelling (q.v.) shows how easily the one may pass into the other. As regards actual Theosophic systems, it is not too much to say that they all originated in the fervid imagination of the East. Through the progress of the Roman arms the theogonies and cosmologies of various Asiatic races became known to the Western world, and, amidst the spiritual ferment which accompanied the decay of the Roman Empire, Theosophy thrived apace, reaching its full flower in the elaborate systems of the Neoplatonists (q.v.) and the Gnostics (q.v.). During the Middle Ages it was usually associated with Mysticism (q.v.), and both the writings of the mystics and the nature-philosophy of the Renaissance exercised much influence over the mind of Boehme (q.v.). The progress of Rationalism, which was the natural outcome of the Reformation, seemed to have given its death-blow to Theosophy; but in recent years a new type, derived directly from the East, has attracted many followers in Western Europe, perhaps through a reaction against the materialism of the age. The chief exponent of the new doctrine was Helena Petrovna Blavatsky (1831-91), who alleged that she had gained her knowledge of esoteric Buddhism in Tibet, where the Theosophical Society claims to have been founded in 1875.

Therapeutics (from a Greek word signifying "to heal") is the science which deals with the use of various remedial agents in the treatment of disease. Inquiry concerning the physical and chemical properties of the materials used, of the sources from which they are obtained, and of the methods of compounding them, is often spoken of as the study of materia medica, while therapeutics proper is held to deal more particularly with the action and uses of drugs.

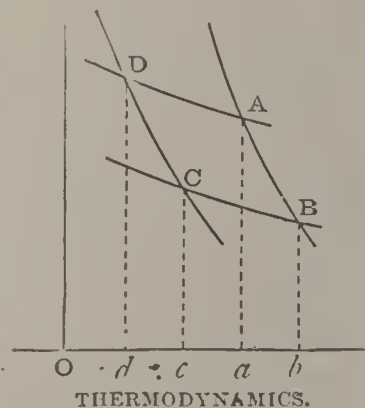
Thermodynamics is a modern branch of the science of heat, and is founded chiefly upon the deductions of Joule, Carnot, and other workers in the same field. Two fundamental principles underlie this science. The first law of thermodynamics states that when heat is used in doing work, the work done is exactly the equivalent of the heat expended, and when work is done to produce heat, the heat produced is exactly proportional to the work done. This follows from the law of the conservation of energy, when it is accepted that heat is a form of energy. But only in modern times has heat been universally regarded as energy; it is true that some of the early Greek philosophers considered it as in some way connected with motion, and speculations on the dynamical theory of heat were rife in the time of Bacon, but by far the greater number of scientists held the opinion that heat was a sort of elastic fluid permeating all bodies—bodies becoming hotter as more of this fluid or caloric was given to them, and colder as it was taken away. Caloric, like matter, was indestructible and uncreatable, and it was finally decided about a century ago that it was weightless, though much doubt had previously existed on the subject. But everything could not be satisfactorily explained by the caloric theory. Friction was known to generate heat, and when a body was ground to powder it was supposed to lose some caloric, which raised its temperature, the heat capacity of the powder being therefore assumed to be less than that of the original solid. Rumford proved the error of this assumption by actual experiment in 1798, but did not succeed in convincing the calorists. He concluded that motion was at the root of the matter, and Davy followed with similar reasoning. In 1840, however, Joule experimentally determined the numerical relation between work spent and heat generated, and stated that 772 foot-pounds of work were capable of raising one pound of water through one degree Fahrenheit. This may be written $w = 772 H$. With different units the number will alter, and in general terms the equation is written $w = J H$, J being called the mechanical equivalent of heat. Experiments were also made on the reverse problem—the determination of the amount of work done by the expenditure of a certain amount of heat—and Hirn showed the connection between the heat given out by the boiler of an ordinary steam-engine and the work done in the same time, allowing for the heat received by the condenser and that lost by radiation, etc. Almost countless experiments have been made to determine the true value of J , the names including Joule, Faire, Hirn, Weber, and workers at the present time, an enormous number of direct and indirect methods having been employed.

The second law of thermodynamics is expressed by Clausius thus:—"It is impossible for a self-acting machine, unaided by an external agency, to convey heat from one body to another at a higher temperature;" while Lord Kelvin states that "it is impossible by means of inanimate material agency to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest of the surrounding objects." We may take

any two substances at different temperatures and theoretically allow the pair to do work. A heat engine is therefore imagined—the body at the higher temperature being regarded as the furnace, and that at the lower as the condenser; the work done is equivalent to the difference of the heat obtained from the furnace and given to the condenser. Heat cannot of itself pass from a colder to a warmer body, but, if *work be done*, then heat can be withdrawn from the cooler condenser, and given up to the hotter source. This involves the conception of a reversible engine, and considerations of such a machine were first investigated by Carnot.

If a substance be allowed to expand against pressure, it does external work, but it does not follow that this external work is at all the equivalent of the heat expended; internal work may also have been done in overcoming molecular attraction, surface tension, electrical forces, and so on. But we may take our substance through a cycle of operations and finish with it in exactly the same state as it was at starting, in which case we get rid of the unknown quantities included under the name of internal work. In the final enumeration of effects, whatever the external work may have been, the internal work cancels out.

Let us take a working substance and subject it to certain alterations of temperature, pressure, and volume. If we take distances measured in the direction OV to represent volumes and those in the direction OP to represent pressures, then the state of a substance represented by A is such that its volume is oa and its pressure aA . Suppose this substance is contained in a cylinder, and that the volume is increased by allowing the piston to rise. Imagine further that the cylinder is in such a position that no conduction of heat can take place. No heat is allowed to enter or leave the substance, while its volume increases to ob . Its path may be represented by the line AB , which is known as an *adiabatic curve*. During this process, as the substance has done external work represented by the area $aABb$ on the diagram and no heat has entered it, its *temperature* must have fallen.



Now remove the cylinder from its non-conducting position, place it in contact with a body at its present temperature, and compress the substance until its volume is oc . Its condition is now represented by the point C . Through this operation its temperature has been kept constant; hence BC is called an *isothermal curve*. Work, represented by $cBbc$, has been done *on* the substance, and so heat must have been given out to the body, called the condenser, with which it has been in contact.

Again place the substance in its non-conducting position, and force in the piston. The varying condition of the substance is shown by another adiabatic curve, CD . Work ($dCcd$) is done *on* the substance; no heat can leave it, and so its

temperature rises. Continue this process till the temperature is the same as at the beginning of the cycle, and the point reached is D. Now put the cylinder in communication with the source of heat, keep its temperature constant, and let it expand isothermally till it reaches A, its starting-point. It does work (D A a d), and takes up heat from the source.

Summing up the results of these four operations, we find a balance of work done *by* the substance represented by the area D A B C, while an amount of heat (H) has been taken from the source at a temperature (T), a quantity (*h*) having been given up to the condenser at a lower temperature (*t*). Carnot's first belief was that H and *h* were equal, but this is disproved by the dynamical theory of heat. In reality the work D A B C is the exact equivalent of H—*h*. This whole cycle of operations is reversible. We can cause the substance to undergo exactly the reverse operations—take in heat *h* at *t*, and give out H at T; while work equal to D A B C is done *on* the body. A *reversible engine* is one in which the working substance can be made to go through a reversible cycle—to pass into its initial or final state alternately, and Carnot proved that a reversible engine must have the highest possible efficiency, efficiency being defined as the ratio $\frac{W}{H}$, where W is the work done by the engine

in one cycle, and H as before is the heat received by the substance at the higher temperature. The efficiency must therefore depend only on T and *t*, and be independent of the substance used. Since $\frac{W}{H}$ is the same as $\frac{H-h}{H}$, we see that in the considera-

tion of efficiency we are dealing with a connection between the quantities of heat H, *h*, and the temperature T, *t*. Upon this connection Lord Kelvin in 1848 based a scale of absolute temperature. An absolute zero was determined, independent of the nature of the working substance. This absolute zero of the thermodynamic scale is practically the same as that of a thermometer based upon the behaviour of a perfect gas.

The second law of thermodynamics may be expressed mathematically as an equation between the heat and entropy (q.v.) of a substance. For further information on entropy and more extensive considerations of the deductions arrived at in thermodynamics, the reader is referred to such books as Maxwell's *Theory of Heat*, a larger work by Preston, and similar literature.

Thermo-Electricity. [ELECTRICITY.]

Thermometer is an instrument for measuring variations of temperature. The volume of a given quantity of air or other gas increases uniformly as its temperature rises, provided its pressure remains constant, and this expansion is made use of in the construction of the *air-thermometer*. A glass tube of small bore terminates at one end in a glass bulb, and in this tube is an index consisting of a drop of mercury. If the air in the bulb is brought to the temperature which is to be measured, it will expand or contract, as the case may be, and its change in volume will be indicated by the motion of the

index; or, the tube being vertical, with the bulb at the upper end, the free end of the tube may dip under the surface of liquid, which will be forced up the tube by atmospheric pressure to a greater or less extent as the temperature of the enclosed air is varied. Owing to the large coefficient of the expansion of gases, air-thermometers may be made very sensitive, but it is necessary always to take account of any variation of pressure. For most purposes a *mercury-thermometer* is more convenient. Here again a capillary tube has a bulb at one end, and the bulb and part of the tube are filled with mercury. The mercury is carefully boiled in the tube, so that all air may be carried away by the mercury-vapour, and the upper end is then hermetically sealed. Coloured alcohol is sometimes substituted for mercury, but is in general less satisfactory. Thermometers may be graduated either by comparison with a standard instrument, or by the following method:—The instrument is surrounded by melting ice, which has a fixed temperature, and a mark is made on the tube at the point at which the mercury comes to rest—this is *freezing-point*, 0° on the Centigrade and Réaumur scales, 32° on the Fahrenheit. It is then immersed in the steam from water boiling at the normal atmospheric pressure, which again is at a fixed temperature, and a second mark is made—this is *boiling-point*, 100° C., 80° R., and 212° F. The interval between these marks is then divided into 100, 80, or 180 divisions, according to which scale is adopted, and the graduation is continued above and below as far as necessary. These graduations are preferably etched on the glass stem, but may be marked upon a paper, or other scale attached thereto. A thermometer is more sensitive as the size of the bulb is greater and the bore of the tube smaller; and in an instrument required to indicate quickly the bulb must be made as small as will give the requisite sensitiveness, and the glass of the bulb should be thin. The glass undergoes a molecular change in course of time, whereby the volume of the bulb is diminished and the zero displaced, and a thermometer should, therefore, not be graduated until it has been made for some considerable time. In registering thermometers a small index is placed in the tube, and is pushed along by the mercury; when the liquid sinks this index is left, and indicates the maximum or minimum temperature which has occurred since the index was set. The indices may be made of iron, in order that they may be replaced with the aid of a small magnet. Metallic thermometers are occasionally used, and consist of a strip composed of two ribands of metal fastened together. These metals are selected so that their coefficients of expansion are as different as possible, and by their differential expansion and contraction the strip bends with changes of temperature. In Immisch's thermometer the tube of a small Bourdon pressure-gauge is filled with ether. The attractions of pressure and volume with change of temperature thus move a pointer over a scale.

Thermopylæ, a pass of ancient Greece, between Mount Œta and a morass upon the Maliac Gulf, where in 380 B.C. Leonidas and his 300

Spartans disputed the passage of the Persian army till treachery led to their being attacked in the rear and utterly destroyed. The pass was forced in a similar manner by Brennus and his Gauls in 279 B.C.

Theseus, the legendary hero of the Ionians, was the son of Ægeus, King of Athens, and Æthra. Among his exploits are enumerated the destruction of Procrustes and other robbers and the Marathonian bull, and especially the killing of the Minotaur. Theseus became King of Attica, and founded the Panathenaic and Isthmian games. He carried off Hippolyte, Queen of the Amazons, and assisted Pirithous to expel the Centaurs; besides descending to Hades, where he attempted the abduction of Persephone, and, being captured, was freed by Hercules.

Thespis, in Greek mythology, the founder of the theatre.

Thessalonians, EPISTLES TO THE. The church of Thessalonica, an important commercial city of Macedonia, was founded by St. Paul in 52 or 53 A.D. during his second missionary journey. It was composed mainly of converted pagans and "devout Greeks," the number of Jews being extremely small. Compelled by Jewish hostility to leave the city, he proceeded through Berea to Athens, and thence to Corinth, where he remained a year and a half. According to the subscription in the *Codex Alexandrinus* and other manuscripts, the letters were written from Athens, but internal evidence shows that their composition took place later, during the apostle's sojourn in Corinth. The First Epistle, the authenticity of which is firmly established, offers general advice and encouragement to the church, alluding, among other matters, to their disappointment at not witnessing the advent of the Lord (iv. 10). The main theme of the Second Epistle is the excitement caused by the expectation that Christ would shortly come, owing to a spurious letter purporting to be written by St. Paul. The apostle brings forward arguments to show that the second advent must be deferred, and in so doing uses language which appears to some critics to be inconsistent with that of the first. For this reason, among others, the genuineness of the Second Epistle has been disputed.

Thessaly, the largest division of ancient Greece, lay to the S. of Macedonia, and to the E. of Epirus, from which it was separated by the Pindus range; mountains shut in the plain on the N., and Mount Othrys separated it from the states on the S. The Vale of Tempe occupied the N.E. The country was very fertile, being watered by the Peneus and the rivers flowing into it, and was noted for its breed of horses. Its origin was said to be Pelasgic, but a later settlement was made by Dorian emigrants who subdued the original inhabitants. After a time of prosperity, its liberties were curtailed by a succession of despotic rulers. It was subdued by Philip of Macedon, and passed later into the possession of the Romans. At a later period Venice held it, and then it passed to

the Turks. A great part of the province now belongs to the kingdom of Greece.

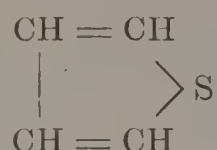
Thick-Knee, any bird of the genus *Oedipodiceps* of the Bustard family, distinguished from the true Bustards by the bill being longer and the wings more pointed. There are about a dozen species widely distributed. The single European species, the Common Thick-knee (*O. crepitans*), visits Britain in summer. The male is about 17 inches long, with brown plumage, mottled with black and white.

Thierry, JACQUES NICOLAS AUGUSTIN (1795–1856), French historian, was born at Blois, and, after leaving college, became a teacher, which profession he abandoned to become a disciple and secretary of St. Simon (q.v.). His earliest work, an unimportant one, appeared in 1816, and he joined the ranks of journalism soon after. Scott's novels had aroused in him a great interest in history, which led to the publication of several valuable works, notably *Histoire de la Conquête de l'Angleterre par les Normandes* (1825), which has become a standard work. The application necessary to complete this work cost him his eyesight. Among his other works may be mentioned the *Dix Ans d'Études Historiques* (1834) and *Récits des Temps Mérovingiens* (1840).

Thiers, LOUIS ADOLPHE (1795–1877), French statesman and historian, was born of humble and poor parents at Marseilles, who gave him a good education, enabling him to study law. He became an advocate in 1819, and in 1821, with his friend Mignet, the historian, went to Paris to seek his fortune. After a struggle, he joined the press, and became known in political circles as a good writer and thinker. He published in 1827 his notable *History of the French Revolution*, which at once gave him an eminent rank as an author. In conjunction with others he founded the *National* in 1830, a successful newspaper, and, after the revolution and accession of Louis Philippe, he became a State Councillor and a member of the Chamber of Deputies. Between 1832–34 he held various posts in the Ministry, and in 1836, after a temporary retirement, he became its head for a short period. In the same year he was admitted to the Academy. In 1840 he was President of the Council and Minister for Foreign Affairs, and during this short tenure had difficulties with England and Germany. Withdrawing from public life, he occupied himself with his *History of the Consulate and the Empire*, which cost him years of labour, and was finally completed in 1860. He later on re-entered public life and again retired, and strongly denounced the Franco-German War of 1870. During the war he became head of the Provisional Government, and in August, 1871, was elected President of the French Republic, which post he held until 1873. His active and eventful life has been written several times, but his rank as a writer or as a statesman is not considered to be of the highest.

Thiophen (C₄H₄S) is a liquid compound which occurs in coal-tar, in which it was discovered by V. Meyer in 1883. It may also be readily prepared

synthetically, the methods of preparation as well as the reactions of the compound indicating the constitution—



It is a colourless liquid, which boils at 84° C. and solidifies at low temperatures. It possesses an odour which closely resembles that of benzene, to which latter compound also thiophen exhibits a most remarkable similarity. By replacement of the H atoms in the compound by other elements or radicals a very large number of thiophen derivatives are obtained. These compounds are recognisable by the formation of a dark blue colour when mixed with sulphuric acid and isatin, a test very characteristic of the thiophen group.

Thiosulphates are the salts of a thiosulphuric acid ($\text{H}_2\text{S}_2\text{O}_3$). The most important, both chemically and commercially, is the sodium salt, which is commonly known as "*hyposulphite* of soda." It is a colourless crystalline salt of composition $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{OH}_2$ readily soluble in water. It is prepared by boiling a solution of sulphite of sodium with powdered sulphur, and is also obtained from the waste liquors of the soda manufacture. It is used in chemistry especially as a reagent for numerous volumetric analyses. It is employed to a large extent in photography as a *fixing agent* [PHOTOGRAPHY], as its solution dissolves the iodide or chloride of silver. It is also employed as an *anti-chlore*, i.e. to remove the last traces of chlorine from materials which have been bleached by that gas.

Thirlwall, CONNOP (1797–1875), an eminent classical scholar and bishop, was born at Stepney, and educated at Charterhouse and at Cambridge. He is said to have known something of Latin in his third year, and could read Greek at four. He had a distinguished university career, and proceeded to the Temple to study law. Finally, he decided to enter the Church, and returned to Cambridge. In 1828 he translated Niebuhr's *History of Rome* in conjunction with Julius Hare, contributing largely to *The Philological Museum* (of which he was one of the editors) during the next few years. His knowledge of Greek history and life was profound, and is evidenced in his admirable *History of Greece* (1835–40), which, though superseded as a whole, is invaluable in some respects. The publication of a pamphlet by him favouring the admission of Dissenters to degrees (1834) resulted in the loss of a tutorship he held at Cambridge, but the Government rewarded him by a good living, and in 1840 he was raised to the see of St. David's, where his extreme zeal and generosity earned him considerable popularity. His published charges are very moderate and just-minded. His *Remains, Literary and Theological*, were published in 1877, two years after his burial in Westminster Abbey.

Thirst. The sensation of thirst is usually referred to the back of the throat, but is caused by a general condition of the body, resulting from lack of fluid. This is shown by the fact that moistening

the fauces is only of temporary benefit in relieving thirst, while the injection of fluid into the blood-vessels, or its absorption from the skin or mucous membrane of the alimentary canal, permanently relieves the condition. Excessive thirst is a characteristic symptom in certain diseases, of which diabetes may be especially referred to.

Thirty Years' War, the name given to the religious struggle which rent Germany from 1618 to 1648, leaving her in a state of exhaustion and demoralisation from which she did not recover till the present century. Its primary cause was the hostility of the Roman Catholics and the Protestants, but the contest between authority and liberty extended to the sphere of civil life, and the Protestant Union of 1608 was formed for political as well as religious purposes. The Roman Catholic states in their turn formed an association under the protection of the Emperor in 1609. The war broke out in Bohemia, where the tyrannical policy of the Emperor Matthias in matters of religion provoked a rebellion, which culminated in the choice of the Elector-Palatine, Frederick V., as king in place of Ferdinand II. (1619). In the same year Ferdinand succeeded Matthias on the Imperial throne. The Imperial forces, which were aided by Spanish troops, eventually prevailed, though the subsequent successes of Count Mansfeld and Christian of Brunswick in the War of the Palatinate (1621–24) to some extent compensated for the failure of the Bohemians. After the accession of Christian IV. to the Protestant cause (1624) the scene of war was transferred to Lower Saxony, but the victories of Wallenstein and Tilly so completely established the ascendancy of the Imperialists that Christian gladly withdrew his support, agreeing to the terms of the Peace of Lübeck (1630). A new champion of Protestantism now appeared in the person of Gustavus Adolphus, who, at the head of a Swedish army, rapidly gained possession of Pomerania and Mecklenburg, crushed Tilly in the battle of Leipzig (Sept., 1631), marched triumphantly along the valleys of the Main and Rhine, inflicted a second defeat on Tilly beside the Lech (April, 1632), and entered Munich. From that town he was drawn by Wallenstein into Saxony, and, though his army was victorious at Lützen, he himself was slain in the battle (November, 1632). For some time the Protestant party was held together through the sagacity of Oxenstjerna, the Swedish Chancellor, but the disastrous defeat at Nordlingen (September, 1634) and the conclusion of peace between Austria and Saxony (May, 1635) led on to the final collapse of the German alliance. The Swedes, however, were determined to retain their conquests in Germany, and opened negotiations with the French, who sent armies to operate on the Rhine and against the Spaniards in the Netherlands. Victory after victory crowned the arms of the Swedes, and, although the French were at first driven back, the ultimate success of Condé and Turenne, culminating in the second battle of Nordlingen (August, 1645), completed the overthrow of the Imperial power. The war was at length brought to a close by the Peace of Westphalia (q.v.).

Thistle, a popular name applied to a number of spinous herbaceous plants, mostly Compositæ. Though the ligulifloral genus *Sonchus* is known as sow-thistle, the thistles proper are almost co-extensive with the tubulifloral tribe Cynareæ, which is characterised by scattered leaves, usually spinous-toothed; an involucre often globose and of spinous bracts; and the flowers all tubular and generally bisexual. *Onopordum Acanthium* is known as the Scottish thistle, a title more applicable to *Carduus lanceolatus*; *Carthamus tinctorius* is sometimes called "saffron thistle" [SAFFLOWER]; and the globe artichoke (*Cynara Scolymus*) is practically a thistle; but most thistles belong to the genus *Carduus*, and are characterised by having several rows of long feathery hairs in the sessile pappus which constitutes "thistle-down" and which rapidly disperses these deep-rooted and troublesome weeds over agricultural land.

Thistle, ORDER OF THE, or OF ST. ANDREW, was instituted by James II. in 1687, and revived by Anne in 1703. The number of knights, originally twelve, was increased to sixteen in 1827. The thistle had been the national badge of Scotland since the reign of James III., and on coins of James VI. (I. of England) is accompanied by the words *Nemo me impune lacesset*. In the motto of the Order *lacessit* has been substituted for *lacet*.

Thlinkeets, North American aborigines, S.E. coast of Alaska from the Atna river to the Queen Charlotte Archipelago (lat. 60° to 56° N., with one inland group, the Tagish, about the sources of the Lewis river. The chief coast tribes are the Auks, Chilcats, Hoodsunus, Hunahs, Hanegas, Sitkas, Stahkins, and Yakutats, with a total population (1890) of 6,437. The Thlinkeets (i.e. "men") are the *Kolushans* of Gallatin and the early Russian writers, so called from their characteristic dish-shaped lip ornament kolosh (properly kaluga), meaning a dish in the language of their Aleutian neighbours. They show affinities both to the Eskimos and the Columbian Indians, and may be regarded as a sort of connecting link between these races; but the language, which is extremely harsh and uncouth, shows no resemblance to those of any of the surrounding populations, and is accordingly classed as one of the native stock-languages. (Gallatin; Powell.)

Tholuck, FRIEDRICH AUGUST GOTTREU (1799–1877), a distinguished German theologian, was born at Breslau, and became professor of theology in Berlin in 1824, and in 1826 professor at Halle, which latter post he held for over fifty years. He was a man of great learning and piety, and was an acknowledged leader of Protestant thought in Germany. He wrote numerous theological works, some of which have been translated into English in Clark's *Biblical Cabinet* (vols. ii., v., vi., xii., xx., xxvii., xxxviii., and xxxix.) and in Clark's *Foreign Theological Library*.

Thomas, CHARLES LOUIS AMBROISE (b. 1811), French musical composer, was born at Metz, his father being a professor of music. In 1828 he

entered the Conservatoire, and obtained several prizes by his proficiency. After a tour in Italy, he settled down in France and produced many beautiful operas and other works, including *Hamlet* (1867) and *Mignon* (1866), to mention two of his most notable pieces. *Mignon* is one of the most successful operas of the century, and its thousandth performance was recently celebrated in Paris with great enthusiasm.

Thomas, GEORGE HENRY (1816–70), American soldier, was born in Virginia, and earned some distinction in the army in his earlier years. On the breaking out of the Civil War in 1861 he received a command, and his prowess soon made his name a household one throughout the Federal States. He fought at Mill Springs, Perryville, Murfreesboro', Chickamauga, and in other important engagements, receiving the thanks of Congress in 1864 after his crushing defeat of General Hood.

Thomasius, CHRISTIAN (1655–1728), German jurist, born at Leipzig, was educated there, proceeding in 1675 to Frankfurt to study philosophy and law. Graduating in 1679 as doctor, he became an advocate, and was appointed professor in Leipzig University, where his innovation of reading his lectures in the vulgar tongue caused a sensation. His ability and knowledge were great, but he made many enemies, and was obliged to seek refuge in Berlin. He was finally professor of jurisprudence at Halle, and exercised considerable influence on the laws of his day. He published some very important works on jurisprudence.

Thoms, WILLIAM JOHN (1803–85), antiquary, was born at Westminster, and entered the secretary's office in Chelsea Hospital in youth. In 1828 he published a *Collection of Early Prose Romances* (3 vols.), and followed it up by various other useful and interesting books, such as *The Book of the Court* (1838), Caxton's *Reynard the Fox* (1844), and *The Longevity of Man* (1873). He is best remembered, perhaps, as the editor and one of the founders of *Notes and Queries*. He was deputy-librarian to the House of Lords.

Thomson, JAMES (1700–48), English poet, was born at Ednam, in Roxburghshire, and was the son of a clergyman. He entered Edinburgh University, intending to study divinity, but gave up the idea, and in 1725 came to London. In the following year he published his first poetical volume, *Winter*, which gave him an assured reputation and three guineas' profit. In 1727 *Summer* was published, and in 1728 *Spring*, a complete edition of *The Seasons* appearing in 1730. During the year or two previous he had brought out several tragedies, which were fairly successful, but are now rightly forgotten. He obtained an appointment as travelling tutor, and as such journeyed over Europe, and on his return was given several other small appointments, a pension of £100 being subsequently given to him by the Prince of Wales. He was often in poverty, and on one occasion was rescued from prison by the generosity of James Quin, the actor. In 1748 he published his well-known *Castle of*

Indolence, which, with his *Seasons*, constitutes his chief claim to renown, his other productions being quite unread and unreadable. There is much keen poetical insight in the works named, and also much that is dull, laboured, and artificial.

Thomson, JAMES (1834–82), poet, was born at Port Glasgow, and, losing both parents at an early age, became an inmate of the Caledonian Orphan Asylum. He managed to educate himself sufficiently to become an army schoolmaster, and served in Ireland and elsewhere in that capacity. He left the army in 1862, and obtained a clerkship. In 1874 his powerful poem, *The City of Dreadful Night*, appeared, and a volume of shorter poems came out in 1880, a posthumous volume being published after his death. His longest poem is very morbid and pessimistic, but shows some genius.

Thomson, SIR WILLIAM, LORD KELVIN (b. 1824), one of the greatest of natural philosophers, was born in Belfast, and educated at Glasgow University and at Cambridge. Even in boyhood he seems to have had remarkable aptitude for natural science, and some extremely valuable papers, written before he reached his majority, led to his being given the professorship of natural philosophy at Glasgow in 1846. To enumerate his many wonderful discoveries and theories would occupy a large space; it suffices to mention his theory of the dissipation of energy (1852), his vortex-atom theory, his calculation of the size of molecules, and his epoch-marking efforts in the science of telegraphy which have given him the unique position he holds. Some of his mechanical inventions are exceedingly ingenious and delicate. He is now President of the Royal Society, and was raised to the peerage for his services to science.

Thor, or THUNDER, was the most popular and in some respects the chief of the Scandinavian gods. In the Northern mythology he is described as the son of Odin and as the defender of Asgard and Midgard against the Jotuns. His palace was the largest in the world, and his terrible hammer is a familiar figure in poetry. His force is represented as doubled when he puts on his wonderful belt of strength. We keep a memory of him in Thursday and in many place names.

Thoracica, one of the four orders of Cirripedia, including those in which the body is protected by a series of calcareous plates. It is the only order that has known fossil representatives. It includes three families:—The Acorn-shells or *Balanidae*, in which the shell consists of from four to eight valves or compartments; the oldest known form is the *Protobalanus* of the Devonian rocks of North America, while *Balanus*, the genus so common on rocks between tide-lines on the British coast, dates from the Cretaceous. The second family, or *Verrucidae*, is less important; the shell somewhat resembles that of the Acorn-shells, but it has only six valves. The type-genus *Verruca* is known in the Chalk, and still lives. The third family, or *Lepadidae*, includes the Barnacles; it is the best known living family, and dates back the

farthest, as *Plumulites* (or *Turrilepas*), a fossil from the Wenlock Limestone of Dudley and beds of the same age in Bohemia, is referred to it. The living genus *Scalpellum* occurs also in the Chalk, while *Pollicipes* ranges from the Rhætic period to the present.

Thoracic Duct. [LYMPH.]

Thoracostraca, or PODOPHTHALMATA, a subclass of Crustacea (q.v.) including those in which the eyes are carried at the extremities of flexible stalk-like appendages. The body is protected in front by a carapace or shield, while the animal consists of twenty segments constructed fundamentally on the same plan, though greatly modified to serve different purposes. The subclass includes four orders:—(1) Cumacea, a group of small forms, not well known popularly, and having no fossil representative; (2) the Schizopoda (q.v.), including the living Opossum Shrimps (*Mysis*), and probably the Carboniferous fossils *Palæocaris* and *Gamptonyx*; (3) the Stomatopoda (q.v.) or Locust Shrimps, with *Diplostylus* from the Coal Measures, *Scudula* from the German Lithographic Stone of Solenhofen, and the many species of the type-genus *Squilla* as fossil representatives; and (4) the Decapoda (q.v.), the best-known order including the Crabs, Lobsters, and Hermit Crabs.

Thoreau, HENRY DAVID (1817–62), an eminent American prose-writer and naturalist, was born in Boston, United States, and became a graduate of Harvard University at the age of twenty. For three years he acted as a schoolmaster, but his strong opposition to the slave trade and constant efforts in favour of abolition brought him into conflict with the advocates of slavery, and he was obliged to give up his calling. He had from an early age been deeply interested in animal and vegetable life, and withdrew into a solitude in Walden Wood, where he had built a small retreat, and pursued his natural history studies. The result is seen in his exquisite book, *Walden: or, Life in the Woods* (1854), which became immensely popular. He settled in Concord finally, where he followed the trade of a pencil-maker. He wrote largely for the periodicals, and published *A Week on the Concord and Merrimack Rivers* and other works.

Thorium (Th = 116) was discovered by Berzelius in 1829 in a rare mineral *thorite*. It is a grey metal, of specific gravity about 7.6, which burns brightly below a red heat. It forms salts corresponding to an oxide ThO, but none are of chemical or practical importance.

Thorn, a fortified city of Western Prussia, is on the right bank of the Vistula (here crossed by a viaduct), 31 miles S.E. of Bromberg. It was founded by the Teutonic League in 1231, and subsequently became a Hanse town. It passed to Poland in 1454, and to Prussia in 1793. It contains a town-hall, some interesting old buildings, and a statue of Copernicus. A conference was held here in 1645 to try and reconcile the Church and the reformers. There is a trade in corn and timber. The majority of the inhabitants are Polish Catholics.

Thorn, a term preferably confined to the rigid woody sharp-pointed modifications of leaf-structures, similar stem-structures being termed *spines*, and mere hypodermal emergences which resemble them, *prickles*. In the teasles, thistles, holly, and *Mahonia* we have surface or marginal thorns on the blade of the leaf; in *Robinia* and *Aeacia* the stipules are thorns; in cactuses and some barberries the entire leaf is reduced to a thorn. Some writers use the terms thorn and spine in a manner the converse of the above.

Thorn-Apple (*Datura Stramonium*), the best-known species of its genus, probably a native of the Caspian region, but commonly occurring on waste ground in England, is a coarse annual solanaceous plant, branching cymosely; with large, terminal, funnel-shaped, pleated, white flowers, followed by four-chambered, four-valved spinous capsules, from which the plant gets its English name. The leaves and seeds contain the poisonous narcotic alkaloid *daturine*, $C_{17}H_{23}NO_3$, an isomer of atropine (q.v.), which is valuable as a sedative in neuralgia, epilepsy, etc. The leaves are smoked as cigars in cases of asthma. It has been conjectured that this drug was used by the priests of Apollo at Delphi to produce frenzy.

Thornback (*Raja clavata*), a common British ray. Its popular name refers to the bony spines on the upper surface.

Thorough-Bass, a system of harmonic composition in which numerals are used to indicate the intervals between each tone of the given bass and the constituent tones of the chords to which it belongs.

Thorwaldsen, ALBERT BERTEL (1770-1844), famous Danish sculptor, was born of very poor parents in Copenhagen, and consequently received a very scanty education; but, having artistic leanings, he was allowed to enter the Art Academy of his native town, and there carried off many honours. In 1797 he arrived in Rome, and worked quietly there, unnoticed for some time, till Canova discovered him, and he was famous. He returned to Copenhagen in 1819, and received a splendid welcome. From 1820 till 1837 he again lived in Rome, and produced his statues of *Mercury* and *The Dying Lion*, his equestrian figure of the Emperor Alexander, and the great bas-relief *The Triumph of Alexander*. Several volumes have been published upon his life and works.

Thou, JACQUES AUGUSTE DE (1553-1617), French historian, was born in Paris, first studied law, and afterwards took holy orders, obtaining a prebend at Notre Dame. His knowledge of law was considerable, and, after travelling in Italy, he was appointed in 1578 ecclesiastical councillor in Parliament, subsequently receiving other places. About 1588 he renounced his orders, and became a Councillor of State, next serving five years under Henri of Navarre. He became Keeper of the Royal Library, and as magistrate warmly supported the Edict of Nantes. He died, it is said, from disappointment in not being appointed first President of the Parliament after Henri IV.'s death. His

chief work is his admirable contemporary history, *Historia sui Temporis* (1604-20), which gave offence to the Vatican by its outspokenness.

Thrace, an ancient district the name of which was somewhat vague in import. It was generally taken to include all the country lying on the W. of the Euxine, between the Ister and the Ægean Sea. Under the Roman rule part became Macedonian and part Mœsian, and the name Thrace was confined to the territory from Mount Hæmus to Propontis, and from the Euxine to the Nestus. It was a land of hills and forests, contained Mount Rhodope, and was watered by the Hebrus. After many vicissitudes, it passed into the hands of the Turks, and part of it is now Eastern Roumelia.

Thraco-Hellenian, a branch of the Aryan linguistic family, including the Albanian, Attic, Byzantine, and Modern Greek languages.

Thrashing. The thrashing-machine was invented by Andrew Meikle, a millwright settled near Dunbar, about 1786. Various improvements have since been introduced, but in all essential features it remains the same. In Meikle's machine the sheaves are pushed forwards with the ears foremost from a slanting feeding-board, and caught between two revolving rollers with parallel grooves. As they emerge from this position they come into contact with a cylinder or "drum" furnished with four projecting ribs parallel to its axle, called "beaters," which strike their heads so as to separate the grain from the straw. After being carried together over the drum, the loose grain and chaff remaining in the straw are removed by two successive "shakers" or "rakes" supplied with several spikes, the whole of the grain passing through wirework below, and thence to a winnowing-machine, where it is separated from the chaff.

Thread-Worms, a name applied to the small, cylindrical worms which form the class of Nematoda. The Common Thread-worm (*Oxyurus vermicularis*) is a Nematode worm [ROUND WORM], and is one of the most common of the parasites which infest the human intestine. The female is rather less than $\frac{1}{2}$ inch long, the male about half this size; the eggs are oval bodies of about $\frac{1}{500}$ of an inch in length in the long diameter. Thread-worms are more common in children than in adults; they inhabit the lower bowel, and usually give rise to itching about the anus. The fact of their presence is readily verified by the detection of the worms themselves or of their ova in the fæces. The local injection of quassia, combined, if necessary, with the use of parasiticide ointments, is usually effectual in destroying the worms.

Thresher. [FOX-SHARK.]

Thring, REV. EDWARD (1821-87), educationist, graduated at King's College, Cambridge, was elected a fellow, and ordained in 1846. In 1853 he became headmaster of Uppingham School, and held the post for many years, during which he published some excellent works, including *Thoughts on Life Science* (1869) and *The Theory and Practice of Teaching* (1883). His *Elements of Grammar*

(1851) has passed through many editions. His biography, by J. H. Skrine, was published in 1890.

Throat, DISEASES OF THE. Sore-throat—that is to say, inflammation affecting the fauces, tonsils, and palate—is a malady of common occurrence. Simple catarrh may involve the throat, and may occur from time to time, constituting the common condition sometimes known as relaxed sore-throat. Hospital sore-throat is a form of disease affecting those who are exposed to the atmosphere of a hospital. When the tonsils are mainly involved in the inflammatory condition, the disease is known as tonsillitis (q.v.). The term quinsy is also applied to acute inflammation affecting the structures at the back of the throat. Soreness of the throat is an important symptom in such diseases as scarlet fever and syphilis, and it may occur in association with rheumatism, gout, etc. The throat is, of course, one of the chief situations apt to be involved in the local mischief in diphtheria. Affections of the larynx are sometimes loosely spoken of as forms of throat disease. [LARYNGITIS.]

Thrombosis. [PHLEBITIS.]

Thrush, a book-name for birds of the Passerine family *Turdidae*, and its type-genus *Turdus*, with numerous species, very widely distributed. Some naturalists restrict the genus to those forms in which the plumage is spotted on the breast in both sexes; in the young these markings extend to the back, but are lost after the first moult. The Song-thrush, or Mavis (*T. musicus*), is common all over Britain. The length of the adult male is about nine inches, the female is a little less. Plumage, olive-brown above; the chest and sides, golden buff, with triangular patches of black. From its power of song it is a favourite cage-bird. The Missel-thrush, or Storm-cock (*T. viscivorus*), is somewhat larger. [BLACKBIRD, FIELDFARE, REDWING, RING-OUZEL.]

Thrush, a disease characterised by the development of white patches on the mucous membrane of the mouth, throat, and tongue. [APHTHÆ.] Thrush is most commonly met with in early infancy, and, under such conditions, is usually attributable to faulty diet, and readily responds to simple remedies. A dose of castor-oil, the addition of lime-water to the milk, and the local application of mel boracis, combined with scrupulous cleanliness and care in the administration of proper food, usually prove efficacious in curing thrush in young infants. When thrush appears in adults, it is often a symptom of grave significance.

Thucydides, who is generally held to be the best of Greek historians, was born near Athens in or about 471 B.C., his family being connected with noble Thracian houses, and very wealthy. From Antiphon he learned oratory, and philosophy from Anaxagoras, and was a resident of Athens during the terrible plague of 430, being one of the few who escaped. He was, according to his own account, a divisional commander in the Peloponnesian War, and in 424 was appointed to a naval command. Evidently he was an unsuccessful soldier, and his failure in that capacity led to his

being banished in 423. His exile was due to his non-success in relieving Amphipolis when besieged by the Lacedæmonians, and lasted for twenty years, which he occupied in travelling about Greece, collecting materials for the work which has preserved his fame to our days—namely, his *History of the Peloponnesian War*, which Alexandrine scholarship has divided into eight books. This work is one of the greatest monuments of antiquity; its narrative is written in a simple, direct, and impartial manner, describing the alleged causes of the war, and never forsaking the subject to dwell upon minor side-issues. He relates the most noteworthy events, like the Plague of Athens, in a masterly manner, and throughout the narrative are interspersed speeches by the principal characters, which, if not of their composition, are such as one might suppose them to deliver in like circumstances. An example of this is the splendid oration of Pericles over the ashes of the soldiers of Athens, which has been accepted as the finest of all Greek utterances by an orator. The involution and difficulty in the style of these is due to his following the rules of rhetoric taught by Gorgias (q.v.) rather than strict grammar, which, indeed, was not yet formulated. The history is arranged as a yearly chronicle of events, but stops short eight years before the proclamation of peace. The eighth book, differing somewhat in style from the rest, has been referred by some to another hand. His own exile ended in 403, and his death is supposed to have occurred from assassination in 401, probably in Thrace, where he had settled, and where he had large estates. His great history was first printed by Aldus in 1502, and since then it has often been printed and translated. The edition by Dr. Arnold (1830–35) is one of the best.

Thugs (from a Sanskrit root meaning “to conceal”), the name of an Indian religious fraternity who lived on the wealth acquired through the murders they committed in the service of the goddess Kālī, the wife of Siva. It was their custom to disguise themselves as merchants, and make use of any favourable opportunity to strangle or poison the travellers whom they met. The Thugs were exterminated by Captain Sleeman, acting under Lord W. Bentinck, in 1828–35.

Thunder is the sound heard when electric discharges take place between different groups of clouds or between clouds and the earth. The clouds observed before or during a thunderstorm have received the name of nimbus; they are often extensive enough to enshroud the earth in darkness, and are characterised by the dark, heavy, and leaden appearance they present. They are found at all distances from the ground; they are often many miles thick vertically, and have the appearance, when seen from afar, of undergoing rapid movements as though they were boiling. To what the thunderstorm owes its origin is still undecided, although many explanations have been suggested, but water has a considerable part to play in connection with atmospheric electricity. Since sound travels comparatively slowly through air, while

light is almost instantaneous, it follows that we see the flash of the electric discharge, *i.e.* the lightning, before we hear the sound, and the difference in the time elapsing between the two is greater the farther away is the scene of discharge. If we watch a flash of lightning, we see it as a long line of light of varied shape. We may consider it as consisting of an infinite number of points of light, *i.e.* as being caused by an infinite number of simultaneous small discharges. But each of these points may not be at the same distance from us; so the sound from the more distant point will reach us later than that from the nearer. Hence the thunder will not sound as a single report to us, but will be lengthened out into a *peal*. When we are very near to the storm, this difference of distance produces so slight an effect that we practically hear all the little reports at the same time, and the result is a loud *crash*. The reflection of the sound from other clouds and from the surrounding hills also modifies the intensity of the thunder, and produces that curious *roll* which is often heard.

Thurlow, EDWARD, LORD (1735–1806), English Lord Chancellor, was born in Suffolk, and was called to the bar in 1758. He had little knowledge of law, but had a certain imposing manner which impressed people, and his rise in his profession was rapid. In 1771 he was Solicitor-General, and in 1778 was raised to the woolsack in return for his services to the Government. Once his ambition was gratified, however, he became an extremely obnoxious person to the Government of Pitt, and strenuously opposed all his measures. Pitt procured his removal from office in 1792. His abilities were of the mediocre order, and Fox's criticism of him is well known. He said, "No man was ever so wise as Lord Thurlow *looked*."

Thurot, FRANÇOIS (1727–60), French sailor, is remembered chiefly by his successful capture of Carrickfergus in June, 1760. He had previously rendered effective service to France as a privateer, and was offered an important command in its navy, with instructions to make a descent on the coast of Great Britain or Ireland. He accepted the command, and Carrickfergus in County Antrim fell into his hands. On his way home, however, he was met by an English squadron, and was killed in the engagement which followed.

Thylacine, a genus of Tasmanian marsupials, with one species (*Thylacinus cynocephalus*). It is about the size of a large dog, with brownish fur marked with black stripes on the back. It commits great ravages in sheepfolds, and the farmers shoot and trap it without mercy.

Thyme, the fragrant genus *Thymus*, belonging to the order Labiatae, with very small leaves and dense terminal heads of reddish florets. *T. vulgaris*, Garden Thyme, a native of the western Mediterranean area, has been used from ancient times as a seasoning. In the south of France an essential oil is distilled from it, which is sold in this country as "oil of marjoram" (q.v.). From this oil the stimulant and carminative stearoptene or camphor *thymol*, which is also valuable as an

antiseptic disinfectant, can be obtained. It is, however, mainly prepared from the mericarps of the Indian umbelliferous plant *Ptychotis Ajowan*, the Ajowan, an ally of the carraway. *Thymus Serpyllum* is the wild thyme of English banks.

Thymol ($C_{10}H_{13}OH$) occurs chiefly in oil of thyme, but is also found in other vegetable sources. It may be obtained by adding caustic potash to the oil and then adding to the solution hydrochloric acid, which precipitates the thymol. It so forms colourless plate-like crystals, which melt at about 44° and boil if heated further. It possesses an odour resembling that of thyme, and is easily soluble in alcohol and ether. It is a phenol (q.v.), and so in many respects resembles carbolic acid; by reduction it yields the hydrocarbon cymene $C_{10}H_{14}$.

Thymus Gland, a glandular body situated in the lower part of the neck. The thymus reaches its maximum development shortly after birth, and from the second year of life onwards gradually atrophies, so that in adult life it is a mere remnant of the original structure. The thymus consists of a number of follicles composed mainly of adenoid tissue. The function of the gland is not well understood, but it appears likely that it is concerned in early life in the development of red blood corpuscles. In hibernating animals the gland does not atrophy, but persists throughout life, and undergoes enlargement just before each period of hibernation.

Thyroid Gland. [GOITRE, CRETINISM, MYXŒDEMA.]

Thysanura, the lowest order of Hexapoda, including the Springtails and Bristletails.

Tibbus, a people of North Africa, who appear to represent the ancient Garamantes reduced by Cornelius Balbus. They occupy all the inhabitable parts of the Sahara east of the Tuareg domain, *i.e.* from about the 13th meridian to the Libyan desert, their chief centre being the Tibesti highlands. The Tibbus, *i.e.* "Rock People," form two main divisions, the northern *Teda* of Tibesti, Borku, and all the surrounding oases as far as Knfra, and the southern *Daza* of Kanem and the eastern shores of Lake Chad. Here they are much intermingled with the Sudanese Negroes, and often present a distinctly Negroid type; but the Tedas, who represent the original stock, have a much lighter complexion and regular features like the Hamitic Tuaregs. But the language is entirely distinct from the Hamitic, and shows strong affinities with the Kanuri and other Negro tongues of Central Sudan. All the Tibbus are rude, unlettered Mohammedans, fierce marauders, treacherous and fanatical; hence their domain still remains imperfectly explored. (Nachtigall, Keane.)

Tiber, a river of Central Italy, rises in the Apennines, flows S.E. to Perugia, then S. to Rome, and then S.S.W. by two branches into the Mediterranean. The northern of these branches is navigable, and the delta is called Isola Sacra. In its course of 260 miles, it receives the Nera, Velino,

and Aniene on the left, and the Paglia, with Chiama, on the right, and is navigable for small vessels to the junction of the Nera. Owing to the mountain torrents that feed it, the Tiber is liable to inundations.

Tiberius, CLAUDIUS NERO CÆSAR (42 B.C.—37 A.D.), the second Roman Emperor, was the son of Tiberius Claudius Nero and Livia Drusilla. His mother subsequently marrying the future Emperor Augustus, he and his brother were reared in the household of their stepfather, and were given the usual training in public affairs. Their military capacity was shown by the defeat of the Rhæti and Vindelici. In 13 B.C. Tiberius became consul, and again in 7 B.C., after having carried on a successful war with Germany. Having been forced by Augustus to divorce his wife, and to marry the infamous Julia, he withdrew in disgust to Rhodes, and did not return to public life till the year 4 A.D., when he was proclaimed as the adopted successor of Augustus. His triumphant victories at the same period in Germany and Dalmatia increased his popularity, and in the year 14 he became Emperor. He instituted various changes in the matter of election of public officers, and in other directions gradually increased the power of the monarchy, his severity in this respect causing much disquiet. Sejanus, commander of the Prætorian Guards, who had the chief direction of affairs, was more cruel than Tiberius, and carried out his instructions with ferocity, and finally Tiberius, excessively suspicious, caused him to be put to death. Retiring to Misenum, Tiberius gave himself up to debauchery, and, having fallen into a trance, was superseded by Caligula. As he awoke, he was suffocated. He was a great soldier, but a man of morbid and gloomy temperament; but we have to depend on very hostile witnesses for our knowledge of his rule.

Tibet, a Chinese dependency of Central Asia, lying between China and India, and between the Kuen Lun and Himalaya mountains. On the E. and S.E. Tibet has for boundary the mountains that separate China and Indo-China, thus forming a huge territory shut in by mountains. The mountains rise from table-lands, which are themselves from 17,000 to 10,000 feet high. The loftiest heights are in the W. and N., sloping to the S. and E., and the lowest parts are where the Indus and Sanpo make their way. Most of the country is unexplored. It is divided into six provinces: (1) Chaidam, containing the Koko-Nur Lake and much marshy land; (2) Katchi, the great northern plain of steppes; (3) Nari, the Himalayan district, in which the Indus and Sanpo rise, a land of pastures, and containing a sacred lake; (4) Manasarowa; (5) Little Tibet, partly belonging to Cashmere and to India; (6) Yu-Tsang, the most populous and important province; (7) Kham, on the upper waters of the Chinese and Indo-Chinese rivers. Some of the country is in a great degree independent, and some under the direct rule of China. The most populous district is the Sanpo Valley. By this river merchandise is carried down in boats made of hides stretched upon a framework

of wood, and, after discharging their cargo, the boats are taken to pieces, and brought back by yaks. The climate is cold and dry, and, after the short hot summer, the cold is extreme. In the N. and W. there are no trees, and the animal life consists of wild yaks, antelopes, horses, asses, and goats. The S. table-lands are inhabited by a nomad pastoral people. Among the minerals are gold, silver, iron, copper, zinc, and mercury. The people are good blacksmiths and cutlers, and they take their goods to fairs and markets upon yaks. Formerly there was a good trade with India, but the Chinese ascendancy has destroyed it. China only interferes in foreign affairs and in military matters, and has two commissioners residing at Lhasa. The government is much in the hands of the priests, and the Dalai Lama is a kind of Pope, who, however, delegates his power to the king, who is aided by four ministers. The Dalai Lama originally received his power from Kubla Khan, who, after conquering the country, was converted to Buddhism. Lhasa was founded in 961 by a king who introduced Buddhism, and the Chinese conquest took place in 1726.

Tibetans (properly *Bod-pa*, "Landsmen," "aborigines"), the indigenous inhabitants of the Tibetan plateau, and of both slopes of the Himalayas from Baltistan ("Little Tibet") eastwards to Bhutan and North Assam; are a Mongoloid people forming a distinct branch of the Indo-Chinese division, with nearest congeners, the Burmese of the Irawadi basin. The type, which, in Burma, approaches that of the soft effeminate Hindus, is marked on the uplands by short, broad, muscular frames, low and broad forehead, black shaggy hair, small hands and feet, dark-yellow complexion, features more regular—that is, less broad and flat, than those of the Mongolians. They are a frank, kindly people, but extremely superstitious, and entirely in the hands of the Buddhist priests, who are the chief landowners and traders of the country. Polyandry is prevalent, especially in the poorer districts, where an increase of population would lead to distress and famine. The Tibetan language, which is a member of the Indo-Chinese isolating group [CHINESE], is spoken with considerable uniformity throughout Tibet Proper and Ladakh, and is written with a peculiar character based on the Devanagari, introduced by the Buddhist missionaries in the 7th century. It has long been cultivated, and possesses a vast literature, rich especially in religious writings. The orthography is historical, and the result is that, as in English, many letters are written which are no longer pronounced. Thus, the *d* of *Bod-pa* is now silent, and the word is pronounced *Bo-pa*. As in the other Indo-Chinese languages, tones have also been developed, at least in the central provinces, to compensate for loss in the current speech of letters recognised in the written language. (Edkins, De Körös, Jäschke, T. de Lacouperie.)

Tibullus, ALBIUS, Latin elegiac poet, was born at Pedum just previous to the great Augustan age, and was therefore a contemporary of Virgil and

Horace. He inherited much property, but most of it was confiscated after Cæsar's death, and he was left with somewhat scanty means. His friendship with Marcus Valerius Messala Corvinus, the Roman general, stood him in good stead, however, and he accompanied that soldier in several of his expeditions, afterwards settling down in his villa at Penum and devoting himself to literature. Very little is known of his life, which was clearly uneventful, but his personal character and writings are highly praised by ancient writers. The date of his death is not exactly known. His *Elegies* are his enduring monument. They are graceful, tender, and natural, and have made him one of the most favourite of Roman writers. The finest edition of them is that printed in Venice in 1472 with the poems of Propertius and Catullus.

Tic Douloureux. [NEURALGIA.]

Tichborne, an estate in Hampshire, $6\frac{1}{2}$ miles N.E. of Winchester, has been in the hands of the same family from Saxon times. The first baronet was created in 1626. But the name is chiefly remarkable for its associations with one of the most memorable trials of modern times. Sir Alfred Tichborne died in 1866, and a claimant appeared to the title and estates in the person of one Arthur Orton, an Australian butcher from London, who professed to be Roger Charles Tichborne, who was lost at sea in 1854. The civil case was tried in 1872 in the Court of Common Pleas, and lasted for 103 days. The case for the plaintiff collapsed, chiefly owing to the searching cross-examination by Sir John Coleridge, afterwards Lord Chief Justice of England, and to the production of evidence that Roger Tichborne had tattoo marks which "the Claimant" had not, and in 1874 he underwent a trial for perjury, the case lasting 188 days, and resulting in a conviction, followed by a term of penal servitude. The cost of this trial was £55,315.

Ticino (or TESSIN), a southern canton of Switzerland, having Italy on the S. and W. and Italy and Grisons on the E. It is situated partly on the S. slope of the Alps; its chief river is the Ticino; and the St. Gothard Railway passes through. Lake Lugano and part of Lake Maggiore are in this canton. In the N. cattle-rearing and dairy-farming are carried on, further S. forests occur, and still further S. is a country of olive, vine, corn, figs, almonds, oranges, citrons, and pomegranates. The capital is Bellinzona, but the largest town Lugano. The river Ticino rises on the southern slopes of Mount St. Gothard, flows S. through Lake Maggiore, then S.S.E. through North Italy, joining the Po 42 miles below Pavia. It is navigable below Lake Maggiore, a distance of 75 miles.

Tickell, THOMAS (1686-1740), poet, was born in Cumberland, and educated at Oxford. He became acquainted with Addison, through whose influence he was appointed Under-Secretary of State in 1717, and afterwards secretary to the Lords Justices of Ireland. As a poet he is chiefly remembered by his ballad of *Colin and Lucy*, but he translated a portion of Homer, wrote an *Elegy on Addison*, and contributed to *The Spectator*.

Ticknor, GEORGE (1791-1871), literary historian, born in Boston, United States of America, was at first a lawyer, but adopted the literary profession, and produced some admirable works, especially the monumental *History of Spanish Literature* (3 vols., 1849), by which he is best known. He was an enthusiastic traveller for some years, and, after settling in Harvard, became professor of modern languages there. He was one of the founders of the Boston Public Library. He published biographies of Daniel Webster (1825), of Lafayette (1831), and of Prescott (1854). His own *Life*, by Hilliard, appeared in 1876.

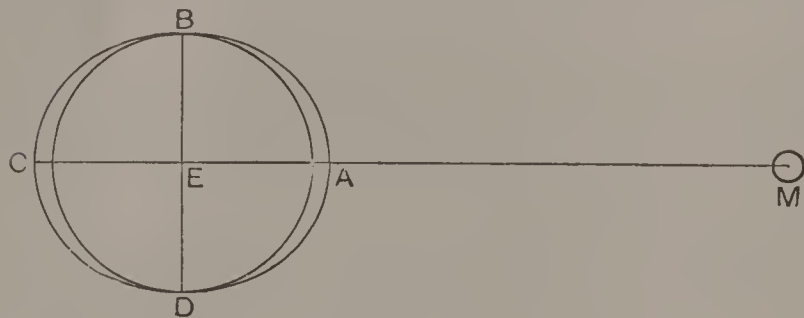
Ticks, a group of Arachnida belonging to the order Acarina (q.v.) or Mites, and forming the family *Ixodidae*. The dog tick (*Ixodes plumbeus*), which lives attached to the hair of the dog, is a well-known representative; this lives probably on vegetable food, and is not a true parasite on the animal to which it attaches itself. Many animals called ticks belong to other groups; thus the sheep ticks are really small wingless flies.

Ticonderoga, a town of New York State, United States of America, on Lake Champlain, 100 miles N. of Albany. The French established a fort here in 1755, but abandoned it four years later. The English spent £2,000,000 upon strengthening it, but its small garrison of 50 men—not more being thought necessary after the cession of Canada—were overpowered by the provincials in 1775. In 1779 General Burgoyne recaptured it, and it was allowed to fall into ruin after the war. The lake-steamers start from here, and the falls supply water-power. Black-lead and iron are the principal productions.

Tides. The rise and fall of the water of the sea has naturally been observed during all time, and the cause of this ebb and flow has been the subject of much discussion. It is noticed that, roughly speaking, high and low water occur twice a day on the sea-coast, or, more accurately, high tide occurs 50 minutes later each day, the time between two high or two low tides being 12 hours 25 minutes. In about a week, then, the times of high and low water are reversed, while after a fortnight they are again as they were before. It is further found that the times of high water are connected with the position of the moon—that, in fact, high water occurs at a certain, but not quite constant, time after the moon has crossed the meridian. The greatest interval elapses between high water and the moon's meridian passage, when the moon is between her first and second quarter or between her third quarter and new moon. The least interval is a week before or after each of these. Not only does the water itself rise and fall, but there is a difference in the height of the tide on different days. The highest tide obtains when the moon is new or full, and at this time low tide is also lowest. But a week later, when the moon is in her first or third quarter, the high tide reaches a far lower point, and the sea does not recede so far at low water. The maximum high tide is known as spring tide, and the minimum as neap tide; there is often a

difference of many feet between the height of the water at these two different times. Although the interval between two successive high tides is 12 hours 25 minutes, this is not equally divided into the times of rising and falling. The sea takes longer to "go out" than to "come in," and this difference is more marked at spring than at neap tides, being more noticeable again in estuaries than at places overlooking the free ocean. The tide always extends for some distance up a river; in the absence of locks it could be felt on the Thames as far as Teddington, but the higher up we go the later is high water observed to occur. In some cases, too, the tide rises so fast that a tremendous up-rush of water takes place, often spreading over the river banks. This is exemplified by the Severn "bore." This naturally causes a higher range of tide, and we notice that at Chepstow the spring tide reaches 50 feet, while lower down, at the mouth of the channel, it is only 18 feet.

Two main theories have been propounded to account for the tides—one known as the equilibrium theory of Newton, and the other as the kinetic theory of Laplace. If the earth were completely covered by water, it would be heaped up in certain places by the action of the sun and moon. The moon attracts every drop of water to herself with a force proportional to her mass and inversely proportional to the cube of her distance from the



TIDES.

particle. If M be the moon and A B C D the earth, the water at A will be more attracted to the moon than the earth, and will therefore become heaped up, while the earth will be more attracted than the water at C; so the water there will be left behind in another heap. At the points B and D the water will sink, so that if the earth and moon were at rest the water would have shaped itself into a prolate spheroid, the long axis of which would point towards the moon. At first sight, it would appear that the effect of the travelling moon would be to attract this liquid form after her, so that as she crossed the meridian of any place she would produce high water there and also on the opposite side of the earth. High tide would thus occur twice in every 24 hours 54 minutes—*i.e.* twice in every lunar day. But this high tide does not occur just when the moon crosses the meridian, and this alteration is due to the fact that the water does not simply follow the moon, but is thrown into a state of oscillation. The moon causes a wave, but she travels much faster than the wave can; she causes another, beats that in turn, and so on; thus a state of oscillation is set up in the ocean. In this case, however, there will not be the tendency for the

water to be highest when the attraction to the moon is greatest. The oscillation has succeeded in inverting the apparently natural occurrence of the tides. It causes low tide to occur immediately under the moon and on the opposite side, while high tide occurs between. This is the reversal of the above figure, and we have now an oblate spheroid with the minor axis pointing to the moon. The observation of actual fact seems to show that low water does more nearly agree with the time required by the oscillation theory than with that deduced from the theory of equilibrium. But great complications arise from the introduction of land into the problem, with its varied shape, and from our scanty knowledge of the effects of the varying depth of the sea.

The sun's influence is now to be considered. It may be roughly calculated that the influence of the moon on the tides is proportional to its mass, and inversely proportional to the cube of its distance. The influence of the sun can be expressed in the same way; but the sun's mass is about 2,700,000 times that of the moon, and his distance nearly 390 times as much. Hence his influence on the tides will be only $\frac{2,700,000}{390^3}$ times that of the

moon. This is less than one-half. The sun, then, acting alone, would produce low water at noon and midnight. A combination of the two will give, as at new and full moon, the maximum effect—*i.e.* about $1\frac{1}{2}$ times what the moon would do alone; and at the first and third quarters the result will be a minimum, only about half the moon's single effect; for in this last case the sun and moon will be acting in opposition to each other, the moon trying to cause high water, while the sun is endeavouring to draw the tide out. This shows the origin of the spring and neap tides; only actual observation shows that the two do not differ as much as the above numbers would indicate. Another inequality is due to the fact that the moon does not travel in the equator; her zenith and nadir distances are not the same for consecutive passages of the meridian on the opposite sides of the earth, and this causes the tides to be of different heights. This alteration in the heights of swelling lunar tides is known as a *diurnal tide*, and vanishes every fortnight, when the moon crosses the equator. For the same reason, two consecutive solar tides differ in summer and winter, when the sun is farthest from the equator, but are of equal height in spring and autumn. The earth's different distances from the sun in different parts of her orbit give rise to a further modification known as the *semi-annual tide*. Local peculiarities naturally produce deviations from the ordinary laws of the tides. Thus, in the Mediterranean, a sea so shut in from the ocean, the tide is hardly felt at all, except in some of the long and narrow bays. Like the bore in the Severn's estuary, the sea rises tremendously in the Bay of Bengal. Colombo, in Ceylon, experiences four tides a day; while at Pampiete, in the Society Islands, high tide occurs regularly at 2 p.m. every day. The average time of retardation of high water at any place is known as the "establishment of the port," and is equal to

the time of high water when the moon is either new or full. When a large wave is started by an earthquake, it is often erroneously called a tide; and the word is often applied, too, to the rise and fall of the sea, produced by definite land and sea breezes and other meteoric phenomena. These are, however, not true tides, for they are not the result of the attraction of the sun and moon, to whose action the word should be strictly limited.

Tidal instruments are for noting and predicting the tides in different places. One form of tide-gauge consists of a float in a tank or pipe filled by water coming from the sea by an inlet below low water. Thus the water in the pipe rises and falls with the sea. The float is supported by a wire connected to a wheel, and the motion of the float is communicated to a fine pencil, which rests against and marks a drum, the latter being caused to rotate once in twenty-four hours; a record of the tide is thus made on the drum. Sir William Thomson's instrument for the prediction of tides consists of a drum, moving proportionally to mean solar time, and marked by a pencil. This pencil is connected to a number of pulleys, each pulley having an harmonic motion and corresponding to one of the lunar or solar tides, which have been found by harmonic analysis of the curves given by the tide-gauge. The pencil then produces on the drum the added effect of these different components, and this is known as a tide-curve. From the tide-curve at any place the height of the tide on any day can be predicted, a result very useful in navigation.

Tieck, LUDWIG (1773-1853), German poet and novelist, born at Berlin, studied at Halle, Göttingen, and Erlangen. His literary activity began early, chiefly resulting in romantic and mystical works. Perhaps his two first notable works are the *Volksmärchen* (3 vols., 1797) and the *Romantische Dichtungen* (1799-1800). The stories first mentioned were afterwards revised and republished in 1812-15, and are considered Tieck's best original work. His translations of *Don Quixote* (1799-1801) and of Shakespeare's plays give him high rank as a translator. Some of his novels and poems are very good, but he is not much read nowadays. His works on the old English drama, *Altenglische Theater* (1811), and on Shakespeare (1823-29) are valuable.

Tien-Tsin, a Chinese city and river-port on the right bank of the Peiho, 34 miles from the mouth, in the province of Chih-li, 80 miles S.E. of Peking, of which it is the port. There is a railway to the mouth of the Peiho, and a brisk trade is carried on with Siberia and Russia, the exports being double of the imports. From December to March the river is frozen, and trade is carried on by means of sledges. In 1858 Tien-Tsin was made an open port, in 1861 a British Consul was appointed, and in 1881 telegraphic communication with Shanghai was opened.

Tierra del Fuego, a group of large and small islands at the southern extremity of South America, in latitude 54° S., separated from the mainland by

the Strait of Magellan, and terminating in Cape Horn. Tierra del Fuego, the chief island, belongs to Chili and Argentina, Staten Island to Argentina, and the remainder to Chili. The coasts are abrupt and deeply indented, but most of the fiords are obstructed by bars. The country is mountainous, rising to a height of 7,000 feet, the snow-line being at 4,000 feet; but there are some fertile valleys. There are no rivers of importance. A Jesuit mission possesses 20,000 sheep, and 6,000 head of cattle. There are some forests, and English flowers will grow. The native animals are few, but among the animals introduced are some half-wild dogs. Birds are plentiful, but seals and sea-lions are becoming scarce. The rocks are volcanic, and the level of the land is rising fast. Some gold and coal are found. There are three varieties of race: the Onas, who are tall, and the Yaghans and Alakalufs, who are short.

Tiger (*Felis tigris*), a large Carnivore of the Cat family, confined to Asia, ranging over nearly the whole continent, from Georgia to the island of Saghalien, and from the basin of the Amoor southwards. Tigers, however, are absent from the great central table-lands and Ceylon; and Sumatra, Java, and Bali are the only islands of the Malay Archipelago in which they occur. Individuals vary in size; about ten feet, including the tail, may be taken as an average size of a full-grown male. The body is covered with short close hair of rufous



TIGER (*Felis tigris*).

shades, with black stripes arranged irregularly, and varying from single streaks to loops and bands. The under-surface is white, and in many individuals there is some white on the face. In the males there is a kind of ruff formed by the long hair extending from the ears round the cheeks. Tigers are principally found in grassy plains or swamps, and the striped colouring harmonises well with the reedy growth of the latter. They take readily to water, and swim well; but, unlike the smaller cats, they do not take to trees, unless pressed by fear. They feed on game-birds, pigs, cattle, and deer, and, when from age or injury unable to hunt their prey, become "man-eaters," frequenting the neighbourhood of villages, and lying in wait for passers-by. Sanderson says that "man-eaters" are

as cowardly as they are cunning, and discriminate with wonderful sagacity between an armed man and a possible victim. The loss of human life in the East from these animals is very considerable, and tiger-hunting is a favourite sport with European sportsmen. The females produce from two to six cubs at a litter, and the young remain with the dam till their third year.

Tiger-Beetles, a family of beetles so called from their fierce habits, and from the spots and stripes with which they are ornamented. The family is known as the *Cicindelidæ*. The best-known English representative is *Cicindela campestris*, which is of a green colour dotted with six white spots on the wing covers. The larvæ of these beetles live in burrows in sand, and capture ants or small insects which pass beside the mouth of the burrow.

Tiger-Bittern, any bird of the South American genus *Tigrisoma*, of the Heron family, named from its variegated plumage.

Tiger-Cat, a loose name for the smaller striped or spotted cats, especially for those that have no distinctive name.

Tiger-Lily (*Lilium tigrinum*), a native of China and Japan, where the scaly bulb which it possesses, like other members of the genus, is eaten as food. It is a favourite in our gardens.

Tillodontia, the name given by Professor O. C. Marsh to a remarkable group of fossil mammals found abundantly in the Eocene rocks of North America. In the typical genus *Tillotherium*, probably more correctly known as *Anchippodus*, the skeleton is carnivore-like, the feet plantigrade, with five long-clawed digits to each, and the skull bear-like; but the molar teeth are of Ungulate type and the incisors rodent-like, so that it seems to be a generalised type combining the Ungulata, Rodentia, and Carnivora. Professor Cope classes these fossils with the similar *Tæniodonta* and the Insectivora (q.v.) in his order *Bunotheria*.

Tillotson, JOHN (1630-94), eminent Anglican divine, was born near Halifax, and, after graduating at Cambridge and receiving orders, he accepted the Act of Uniformity, and became rector of Keddington in 1663. He was rapidly promoted, and in 1671 was made Dean of Canterbury, succeeding Sancroft (q.v.) in the see in 1691. His *Sermons* were remarkably popular, and gave him a very high place among English divines. His widow received 2,500 guineas for them, and they have been frequently reprinted, and are still read. They were published in 3 vols. in 1707-12. In 1752 a *Life of Tillotson* appeared.

Tilly, JOHANN TSERCLÆS, COUNT VON (1559-1632), a famous general in the Thirty Years' War, was born in Brabant, of Catholic parents, and was intended for the priesthood; but, though he always retained a fervent and even fanatical religious spirit, he preferred military service, and served under Alva in the Netherlands and later in Hungary. He commanded the Bavarians, and inflicted successively disastrous defeats on the Bohemians, on

the Duke of Brandenburg, and on Christian IV. of Denmark, and sacked Magdeburg. He was finally twice defeated by Gustavus Adolphus, and died of his wounds and of his chagrin directly after the second repulse.

Tilsit, a town in East Prussia, celebrated as being the place where the treaty between Napoleon and Alexander I. of Russia was signed in 1807.

Time can be measured by any phenomenon which is periodic and regular. The rotation of the earth, or the apparent rotation of the celestial sphere, was naturally used from the earliest days as a measure of time. [STANDARD OF TIME.] Whatever instrument may be used as a measure of time, some means must be adopted to control it. Thus, though the swing of a pendulum of a clock or the balance-wheel of a watch may be perfectly regular, we must compare the readings on the instrument with some standard, in order to avoid confusion between different timekeepers. In modern times the positions of the sun and certain standard stars have been accurately determined for every day with regard to the meridian of Greenwich. A comparison of the reading of a watch or clock with an observation made on one of these fixed objects enables the error of the watch to be found and so corrected. Several observations made in this way will give the rate of gain or loss of the watch. Sundials have been used from very early days to determine the time, and water or sand clocks were the rough gauges in remote antiquity. The regulation of these primitive timekeepers can have been at best only an approximation, but in the time of Hipparchus the right ascensions of certain stars—one of which culminated every hour—were used as references.

Nowadays elaborate systems of astronomical measurements have given a means of accurately obtaining mean solar time, and it is quite easy to correct the time as shown by the sun on a dial to this standard time by the application of the equation of time, the value of which is given for every day in the year in the *Nautical Almanack*. The time at different places on the earth's surface is naturally different, only those places on the same meridian being alike in this respect. Thus, when it is 12 o'clock at Greenwich, it is an hour later 15 degrees to the east and an hour earlier the same distance to the west, a difference of four minutes of time corresponding to every degree in longitude. Birmingham time will therefore be earlier than Greenwich time by 7 minutes 24 seconds. On account of the rapidity with which different places are now put into communication with each other, both by means of railway and telegraph, the local time of a place has gradually fallen into disuse, and it is customary to use Greenwich time over the whole of Great Britain; this naturally greatly facilitates the construction of railway time-tables, and in many ways is extremely convenient. The legend "Synchronised hourly from Greenwich" now seen on clocks all over the country shows how important this convention is considered. Paris time is adopted all over France, while Holland and Belgium use Greenwich time, and Germany and

Switzerland adopt "Central European" time, which is one hour earlier than Greenwich. It has been suggested that Greenwich time should be used all over the world, which would mean that people would have to get accustomed to the new time of day suggested to their minds by the mention of any hour; in New York, for instance, noon would not then be 12 o'clock, but would be 3 minutes 56 seconds past 7 P.M. This suggestion has not, however, been favourably received. The United States extend between longitude 65° W. and 125° W. approximately, thus covering about 60° ; hence there will be a difference of four hours between the times in the eastern and western States. A conventional division of the States into four time-regions is therefore adopted. Between longitude $67\frac{1}{2}^{\circ}$ and $82\frac{1}{2}^{\circ}$ that time is accepted which corresponds to longitude 75° , *i.e.* 5 hours earlier than Greenwich—this is known as Eastern time; from $82\frac{1}{2}^{\circ}$ to $97\frac{1}{2}^{\circ}$ it is Central time—an hour earlier than Eastern; between $97\frac{1}{2}^{\circ}$ and $112\frac{1}{2}^{\circ}$ Mountain time prevails, and lastly between $112\frac{1}{2}^{\circ}$ and $127\frac{1}{2}^{\circ}$ they have Pacific time. It is thus 5 o'clock in the Eastern region when 2 o'clock is registered in the Pacific. On board ship it is customary to make the time correspond to the longitude at noon every day. In crossing from Liverpool to New York the boat will increase its longitude about ten degrees a day; so, when the clocks and watches show that 24 hours have elapsed since the previous noon, it yet wants 40 minutes to the true noon of that meridian in the ocean; when the true noon arrives, all the ship's watches and clocks are promptly put back 40 minutes. If this were not done, the time shown by the clock would bear no relation to the actual part of the day, and on arriving at New York an error of five hours would have accumulated. The ship's chronometer, however, goes steadily on, and the difference in time shown between it and the mean time obtained from corrected observations of the sun gives the longitude of the ship. The importance to navigation of an accurate chronometer is therefore enormously great. In travelling round the world with the sun the hands of a watch would have to be put back 24 hours in all by the time that it got back to its starting-point; this is popularly expressed by saying that a day is lost in the journey. This leads to a curious confusion in the name of the day. Imagine that it is 12 o'clock noon on a Wednesday at Greenwich; at New York it is about 7 o'clock in the morning of the same day, while Pacific time gives it as only 4 A.M. Further on it would be, say, 1 A.M. of the same Wednesday, while in Japan it might be considered as 9 P.M. on *Tuesday*. But if we took countries to the east of Greenwich, we should find that when it is 12 o'clock on Wednesday there, St. Petersburg records two hours later, on the meridian of Calcutta it is 6 o'clock on Wednesday evening, and in Japan three hours later on the same day. According to this, then it may be 9 o'clock in Japan on either Tuesday or Wednesday, while it is noon here. To overcome this inconvenience, the meridian of 180° is chosen as the critical point where the day suddenly changes its name. A ship, travelling westward, say long. $179\frac{1}{2}^{\circ}$ W., on a Tuesday, will,

after crossing the meridian of 180° , suddenly assume it to be Wednesday, although only a few hours have elapsed. If it arrive there at midnight on Monday, Tuesday becomes avoided altogether. But a vessel travelling to the east across this line has one day twice over; thus, if it reaches the line at 11 P.M. on Tuesday, the time is suddenly said to be 11 P.M. on Monday, and so Tuesday comes over again.

Times, THE, the leading newspaper of England, was founded by Mr. John Walter (1739–1812) in 1785 under the title of the *London Daily Universal Register*. From January 1, 1788, onwards it was called the *Times*, the old name being retained for a while as a sub-title. It did not meet with any remarkable success before the appointment of the second John Walter (1776–1847) as manager (1803). Owing to his energy in collecting recent and trustworthy news from all parts of the world, as well as the ability and independence of its criticism of the Government policy, the *Times* rose rapidly in public estimation. Its sale was greatly increased after the adoption of the Koenig steam printing-press in 1814. The leading position always maintained by the *Times* must in large measure be ascribed to its successive editors, Sir John Stoddart (1812–16) and Thomas Barnes (1816–41), who was ably seconded by the "Thunderer" Edward Sterling, John T. Delane (1841–79), and Thomas Chenery, who was succeeded in 1884 by Mr. G. E. Buckle. In 1847 Mr. John Walter (b. 1818), grandson of the founder, became proprietor. He was fortunate in his manager, Mr. John C. Macdonald (1822–89), who, among other improvements, introduced the Walter press in 1869. The *Times* earned the gratitude of the commercial world by its exposure of the conspiracy hatched in Belgium to defraud the principal banking-houses of Europe (1841). The publication of a series of articles entitled "Parnellism and Crime" brought on a chain of events which hardly enhanced the journal's reputation, but its position is probably too secure to be seriously endangered.

Timoleon, Greek general, was born at Corinth early in the 4th century B.C. He was of noble family and of noble character, and, though he once saved his brother's life, he procured his death when he attempted to act tyrannously, atoning for the act by twenty years' retirement. In 344, when fifty years old, he led the Corinthians against Dionysius the Younger, and became master of Syracuse, afterwards driving the oppressors out of Sicily. He then resigned, and led a life of self-sacrifice, dying about 377 B.C.

Timon, the misanthrope, whom Lucian and Shakespeare have brought upon the stage, was born near Athens, and lived during the Peloponnesian War. Various reverses of fortune and desertion by his friends were the cause of his hatred of mankind, and he withdrew into solitude.

Timor, the largest and most easterly of the Lesser Sunda Islands in the East Indian Archipelago, separated from North Australia by the

Arafura Sea. It is 300 miles long from N.E. to S.W., with an average breadth of 60 miles, and has an area of about 12,000 square miles. The number of inhabitants is supposed to be about 500,000. The surface is rugged and mountainous, reaching a height of 11,500 feet. Timor is less volcanic than the neighbouring islands. The principal exports are sandalwood, maize, and ponies. The whole of the western portion of the island belongs nominally to Holland, and the eastern portion to Portugal, but large districts are still ruled by native chieftains.

Timothy, AND Titus, EPISTLES TO. The epistles to Timothy and that to Titus are called the "Pastoral Epistles" of St. Paul, because they treat of matters connected with the discharge of the pastoral office. They have many features in common, both as regards style and terminology and the general nature of their contents. As to the latter, the most noteworthy points are the absence of discussion concerning questions of doctrine, which are assumed to be settled, and the importance attached to an organised visible church. It is certain, both from internal and external evidence, that they were composed at very short intervals of time, and cannot belong to an earlier date than the reign of Nero.

Timothy-Grass, or CAT'S-TAIL (*Phleum pratense*), one of the most valuable agricultural grasses, on account of its productiveness and early development, though a British species, was introduced as a novelty from the United States, from which country we import over $1\frac{3}{4}$ million pounds of its seed annually. It derives its popular name from its spicate inflorescence, and serves as a badge of the Sutherland family.

Tin ($\text{Sn} = 118$) is one of the metals known to the ancients, and of which mention is made in the earliest writings. It is, however, not widely distributed, the most abundant source of the ore being Cornwall, and there seems to be some evidence that the Phœnicians obtained the metal from tin-mines of that district. The chief ore—indeed, the only one employed for the extraction of the metal—is the dioxide SnO_2 , known as *tinestone*, which also occurs in Mexico and Australia. For the purpose of obtaining the metal, the ore is first crushed and then washed, in order to get rid of the lighter earthy impurities. It is next roasted in a reverberatory furnace, and by this operation sulphur and arsenic, which are usually present, are expelled. It is again washed to dissolve soluble matters, chiefly copper sulphate, and finally reduced by heating it together with lime and coal-slack in a reverberatory furnace, the heat being raised very gradually. A slag is formed by the union of the lime with siliceous matters, which rises to the top, while the reduced metal sinks to the bottom, and is run off into pans or ingots. The metal is purified by heating slowly and pouring away the more easily fusible portion, which is further purified by melting in a large pot and stirring with a wooden pole. When pure, it is a bright white soft metal, very malleable, so that it

may be beaten out into thin leaves (*tin-foil*). Just below its melting-point, however— 230°C .—it becomes very brittle. It has a crystalline structure, and a rod of the metal emits a peculiar crackling sound when bent. It does not oxidise on exposure to air, but, if very strongly heated, it burns with a bright white light. Dilute nitric acid oxidises it to a white oxide, and it is slowly attacked by hydrochloric and sulphuric acids. It forms two series of salts, the *stannous* and *stannic salts*, and of these the most important are the chlorides. Stannous chloride (SnCl_2) is known commercially as salts of tin. It forms bright prismatic hydrated crystals, which are soluble in water, but decomposed by excess. It is a strong reducing agent, and is largely employed as a mordant in dyeing and calico-printing. Stannic chloride (SnCl_4) is also used in a crude and impure state by dyers, and known as *composition*, while a double salt with sal ammoniac is also employed under the name of *pink salt*. The artificial *stannic sulphide* (SnS_2), called *mosaic gold*, is employed as a bronzing powder; while the dioxide (SnO_2) finds application as a polishing agent for stones, etc., and is extensively used by lapidaries, to whom it is known as *putty powder*. Tin unites very readily with other metals, *e.g.* lead or copper, and the alloys are in many cases most important products. Thus, Britannia-metal, pewter, Queen's-metal, and the various varieties of solder, are alloys, consisting chiefly of tin and lead. Speculum-metal, employed largely for optical purposes, is an alloy of tin and copper; while bronze, gun-metal and bell-metal contain also essentially the same constituents. The chief use of the metal is, however, for the manufacture of *tin-plates*. Such tin-plates are used for innumerable purposes, as *e.g.* the manufacture of basins, jugs, biscuit-tins, and the tin vessels for the preserved fruits, meats, etc. Chemically, tin is usually recognised by its sulphides, or by reduction before the blowpipe, and is quantitatively estimated in the form of the dioxide.

Tinamomorphæ, in Huxley's classification a name for the Tinamous (q.v.).

Tinamous, a group of South American birds, of partridge-like aspect, but allied to the Ostriches.

Tincal, a crude and impure borax, which is obtained as deposits in various localities, owing to the evaporation of the water from lakes in which the salt had been held dissolved. [BORAX.]

Tincture, a form of medicinal preparation in which certain active principles are extracted and dissolved in spirituous solution. Rectified spirit is usually employed when the substance to be acted upon is a resin or volatile oil; in other instances proof spirit is used. Ammonia enters into the composition of some of the tinctures.

Tindal, MATTHEW (1656–1733), English Deistical writer, was born in Devonshire, and graduated at Oxford, becoming a fellow of All Souls' in 1678. He earned some notoriety by his erratic changes of religion, becoming in turns of High Church, Catholic, Low Church, and Deistical opinions. He

published various works distinguished by their learning and straightforwardness, his best being *Christianity as Old as the Creation*, published anonymously in 1730. It attacks the accuracy of the Scriptures, and evoked many replies.

Tinder was a substance used as a means of starting fire before the introduction of phosphorus matches. It was an inflammable material, often composed of half-burnt flax, and took fire on receiving the sparks caused by the rapid rubbing of a flint and steel. The ignited tinder could not, however, be used directly as a torch, for it only smouldered—no flame was produced. A match dipped in sulphur was first kindled from it, and, after all these steps, the same point was reached as is now obtained by us after one swift rub of a modern match.

Tinea, the name sometimes applied to the parasites met with in certain forms of skin disease. For the ordinary *tinea* (or *trichophyton*) *tonsurans* see RINGWORM. The diseases known as *farus* and *tinea versicolor* are caused by allied forms of parasites.

Tinneh. [ATHABASCANS.]

Tinnitus Aurium, singing in the ears, is a symptom of certain forms of local mischief affecting the ear, and may be produced as a result of the administration of certain drugs, notably salicylate of soda.

Tin-Plate, iron-plate coated with tin by immersing it in the latter metal. The superior kinds of tin-plate are made from iron refined with charcoal, whereas in "coke-plate" puddled iron is used. The process called "pickling" consists in dipping the plates in hot sulphuric or hydrochloric acid mixed with water in the proportion of 1 to 16. They are then washed, annealed, rolled between chilled and polished iron rollers, annealed again, placed a second time in the sulphuric acid, washed once more, and finally scoured with sand, after which they are ready to receive the coating of tin. This is a highly elaborate process, involving a long series of operations. The manufacture of tin-plate is supposed to have been invented in Bohemia in the early part of the 16th century. [TIN.] It has long been the leading industry of Swansea, though since the introduction of the McKinley tariff it has much declined there, and has in part been transferred to the United States.

Tinstone is the most important ore of tin, and consists chemically of the dioxide of that metal, (SnO_2). It occurs largely in Cornwall, frequently in veins in granite rocks, and associated with ores of iron and copper. It forms prismatic crystals, usually of a brown colour, possessing a specific gravity of about 7, and sufficiently hard to mark glass.

Tintoretto, IL (1512-94), a celebrated Venetian painter, received his cognomen from his father's trade, that of a dyer. His real name was JACOPO ROBUSTI, and he was born at Venice. He began his studies under Titian, but abandoned that

painter's studio, and pursued them with such fervour after his own manner that Del Piombo declared it would take him two years to paint as much as Tintoretto could do in two days. He produced a large number of works, chief amongst which are his *Crucifixion*, *Marriage of Cana*, *Last Supper*, *Belshazzar's Feast*, *Last Judgment*, and *Slaughter of the Innocents*. Some of these were executed for Venetian churches. His imagination is of the boldest and most effective kind, and his treatment of chiaroscuro is often magnificent.

Tipperary, an Irish county in the province of Munster, bounded N. by Galway and King's County, E. by Queen's County and Kilkenny, W. by Clare and Limerick, S.E. by Cork, and S. by Waterford. The length from N. to S. is 70 miles, the mean breadth 26 miles, and the area 1,659 square miles. The surface is mostly level, with a fertile soil of calcareous loam. The most productive district is the Golden Vale in the S., which extends through the county north of the Galtee Mountains (3,008 feet) from Limerick to Waterford. The Knockmeledown Mountains (2,609 feet) stretch along the S. boundary, and towards the N. the heights including the Devil's Bit and Keeper Mountain lie N.E. and S.W. for some 18 miles. The most important rivers are the Suir and Shannon. Dairy farming is the principal industry. Tipperary, the county town, is situated on the Arra in the Golden Vale, 29 miles S.E. of Limerick. It carries on a large trade in butter.

Tipu Sahib (1750-99), the most redoubtable enemy England has ever encountered in India, was the son of Hyder Ali, and reached the throne of Mysore in 1782. His intense hatred of England was developed early, and in his youth he attempted to wreak his vengeance on all who favoured her. He took a prominent part in the war which was raging in 1782, but consented to a treaty in 1783. From 1790 to 1793 he was again at war with the British, who pressed him hard, and a third war broke out in 1799. He was killed at Seringapatam, which was successfully stormed by the British in that year, and with his death was destroyed, perhaps, the last really important obstacle to British rule in India. He was mercilessly cruel to his prisoners, and relentlessly forced Islamism on the inhabitants of the Malabar coast.

Tiryns, a Peloponnesian city, situated on a small rock of oval form in the marshy plain of Argolis, to the S.E. of Argos, about 3 miles from the Argolic Gulf. Its "Cyclopean" walls belong to a period anterior to the Dorian immigration. About 468 B.C. it was destroyed by the people of Argos. The excavations of Dr. Schliemann (1884-85) have brought to light a palace of the 11th or 10th century B.C.

Tischendorf, LOBEGOTT FRIEDRICH KONSTANTIN VON (1815-74), one of the greatest of Biblical commentators, was born in Germany, and studied theology at Leipzig, where he afterwards became professor. He travelled extensively in the East, and procured most valuable materials for his revision of the text of the New Testament, of which

the eighth edition appeared in 1869-72. Nearly all his labours are in the direction of textual criticism of the New Testament, and his efforts are highly prized by Biblical scholars.

Tissues, VEGETABLE. [HISTOLOGY, VEGETABLE.]

Tit, the popular name of any bird of the typical group of the Passerine family Paridæ. The birds of this group are widely distributed, but more abundant in the northern than in the southern hemisphere. The short, strong bill is feathered at the base, the wings are of moderate length, the tail is rounded or even, the legs are slender, and the long, curved claws give these birds a firm grip of the branches of trees, to which they often cling back downwards in search of insects, which constitute their chief food. Grain and fruit, however, do not come amiss to them; at times they will feed on carrion, and they occasionally prey on young and sickly birds. The Blue Tit (*P. cæruleus*) and the Coal Tit (*P. ater*) are the commonest British species. The former owes its name to the bluish tinge in its plumage, the latter to its black head and neck. The Great Titmouse (*P. major*), or Ox-eye, about six inches long, is black on the head and throat, white on the cheeks, yellowish on the back, breast, and sides, and has the wings and tail grey. The Crested Tit (*P. cristatus*) is rare and local. The Long-tailed Tit (*Acredula caudata*), also called the Bottle Tit from the shape of its nest, is common. The Marsh Tit (*P. palustris*) is rare, as is the Bearded Tit or Reedling (*Panurus biarmicus*), which belongs to another family.

Titanium (Ti = 50) is a rare metal, which was discovered towards the close of the last century in the mineral *menaccanite*. The pure metal is only obtained with much difficulty, and, if heated in air or oxygen, burns with great brilliancy. Its oxide (TiO₂) is the chief source of the metal and its compound, and is remarkable, as it occurs in three distinct crystalline forms of varying specific gravity and other physical characters. These forms are known as *anatase* (q.v.), *rutile* (q.v.), and *brookite* (q.v.). With alkalis it forms unstable salts, the *titanates*, but neither these nor the salts of titanium itself are of any commercial importance.

Titans, in Greek mythology, were the six sons and six daughters of Uranus (Heaven) and Ge (Earth). They rebelled against Uranus and deposed him, setting up Kronos, the leading Titan, in his stead. The Titans, in their turn, were vanquished by Zeus, the son of Kronos, and hurled into Tartarus.

Tithe is an incorporeal hereditament payable by the inhabitants of a parish for the support of the Church, and generally payable to the parson, and is the tenth part of the increase yearly arising and renewing (1) from the profits of the lands, (2) from the live stock upon lands, and (3) from the personal industry of the inhabitants. The first species of tithe is known as *predial*, and consists of corn, grass, hops, wood, and the like; the second,

mixed, as of wool, milk, pigs, etc., consisting of natural products, but nurtured and preserved in part by the care of man; the third, *personal*, as of manual occupations, trades, fisheries, and the like. The distinction between *predial* and *mixed* tithes is that predial tithes (so called from *prædium*, "a farm") are those which arise immediately out of the soil, either with or without the intervention of human industry, and mixed are those which arise immediately through the increase or produce of animals which receive their nutriment from the earth and its fruits. Personal tithes are so called because they arise entirely from the personal industry of man. In addition to this distinction, tithes are divisible into two classes, viz. great and small: the great tithes comprehending generally the tithes of corn, peas, beans, hay, and wood; and small tithes all other predial, together with all mixed and personal, tithes. Tithes are great or small, according to the nature of the things which yield the tithe, without reference to quantity. Thus, clover-grass made into hay is of the nature of all other grass made into hay, and consequently is a great tithe; but, if left for seed, its nature becomes altered, and, like other seed, it becomes a small tithe. The Tithe Commutation Acts have substituted a yearly rent-charge varying in amount for tithe. By the Tithe Act, 1891, it is payable by the landowner to the titheowner. Every contract between landowner and occupier made *after that Act* for payment of it by the occupier is void; and the occupier has ceased to be bound by any such contract made *before that Act*, being liable, however, to repay to the landowner such sum as the landowner has properly paid on account of tithe rent-charge to the titheowner. When the rent-charge was in arrear for twenty-one days, the remedy was, until 1891, in every case by distress on the land; but the Tithe Act, 1891 (54 Vic. c. 8), has effected a great change in this respect. By that Act, in the ordinary case of land being let by the owner to a tenant, the remedy of distress by the titheowner is abolished; and recovery through a receiver, appointed by the County Court of the district, is substituted, except where the land is in the occupation of the landowner, in which case an officer of the Court may distrain for it. The landowner, also, in case of a contract before the passing of the Act (March 26, 1891) binding the occupier to pay tithe, may recover by distress on the occupier any sum he may have paid the titheowner on account of tithe. By the same Act (*see*. 8) a remission of tithe rent-charge for any one year, exceeding two-thirds of the annual value of the land out of which it issues, may be obtained from the County Council, as in the case of landlord and tenant.

Titian, VECELLI (1477?-1576), greatest painter of the Venetian school, was born in the Friulian Alps, and at the age of eleven was sent to Venice with his brother to take lessons in drawing from the leading masters there. Details concerning his early life are somewhat scanty, and it was not till 1507 that he was engaged on any work of importance, being then occupied in fresco-painting with

Giorgione. The influence of the latter is strongly marked in his first paintings. About 1512 he executed his famous picture of *The Tribute Money*, and in the next year was commissioned to paint *The Battle of Cadore* on the walls of the Hall of Council, in Venice. This work, owing to his being largely employed by Pope Leo X. at Rome, was not finally completed till 1837. His fame steadily increased, and there was a demand for his services at various courts, and his careful business methods procured him large sums of money. In 1523 he married, his wife dying in 1530, leaving him two sons and a daughter. One of the sons became a bishop, but his profligacy was such that Titian's later years were rendered unhappy by reason of it. The other son became a painter of some ability. In 1532 Titian was introduced to the Emperor Karl V., whose portrait he painted, being rewarded by a life-pension. In 1545-46 he was in Rome, fêted by his numerous admirers. His death, at a great age, was caused by the plague of 1576. He stands, with Michael Angelo and Raphael, his contemporaries, at the head of the Italian Renaissance, and has been described as the greatest painter of romantic landscape, as well as of dignified, and sometimes sublime, portraiture. His marvellous sense of colour has been the wonder of the great critics of the Italian painters. His best known paintings are *St. Sebastian*, *Annunciation*, *Christ in the Garden*, *Danæ*, *Noli me Tangere*, *Medea and Jason*, *Venus and Adonis*, and *Bacchus and Ariadne*. The National Gallery possesses some fine works of his, including the last-mentioned.

Titians, or TIETJENS, TERESA (1834-77), celebrated vocalist, was born in Hamburg of Hungarian parents, and, going on the stage at the age of sixteen, was speedily recognised as one of the greatest singers of her time. She first appeared in London in 1858, and created such a *furor* that she made England her home. Her generous disposition endeared her to thousands.

Titlark. [PIPIIT.]

Titmouse. [TIT.]

Titus, FLAVIUS SABINUS VESPASIANUS (40-81 A.D.), Roman Emperor, was son of the Emperor Vespasian, and, entering the army in youth, served under his father, assisting in the capture of Jerusalem. His father, commonly called Vespasian, was of humble origin, and managed to obtain great honours, and finally the crown itself, by his military exploits. He succeeded Nero in 66, and left his son to complete the conquest of Jerusalem. On the return of the latter, they shared the royal dignity till 79, when Titus the Younger became sole emperor. Both left excellent memories behind them, their wise rule endearing them to the people. It is believed that the younger Titus, to whom we owe the Colosseum, was poisoned by his brother Domitian.

Toad, any individual of the Amphibian genus *Bufo*, type of a family (*Bufo*idæ) distinguished from the Frogs (*Rana*idæ) by the want of teeth, the warty skin, and the short hind legs. Of the type-

genus, universally distributed except in Australia, there are fifty-eight species, of which but two are British—the Common Toad (*B. vulgaris*) and the Natterjack or Rush Toad (*B. calamita*). The former is abundant, and frequents damp places, coming out at dusk in search of insects, slugs, and worms; the latter, readily recognised by the bright-yellow line running down the back, is rarer, and is generally found in dry places. Gilbert White records the fact that in his garden at Selborne they were more abundant than common toads. The toad is heavier and more stoutly built than the frog, brownish-grey in colour, with the glands above the ear greatly developed so as to form prominences. It is erroneously supposed to “spit” poison; but is in no wise venomous, though the secretion from the skin is acrid, and when startled or irritated it will often eject clear watery fluid from its vent. Toads hibernate in winter, and in spring the long strings of eggs may be seen floating in ponds. [AMPHIBIA, FROG, SURINAM TOAD.]

Toadflax, the popular name for the scrophulariaceous genus *Linaria*, derived from the flax-like foliage of the common species *L. vulgaris*, the prefix *toad*- being a contemptuous indication of its valuelessness for fibre. This genus is distinguished from the closely-allied snapdragons (*Antirrhinum*) by the corolla having a spur in lieu of a pouch.

Toadstools, the name ignorantly applied indiscriminately to all agariciform fungi except the mushrooms, at first from the curious ancient belief that they owed their origin to toads, as puff-balls were supposed to owe theirs to wolves, and the deer-ball truffle (*Elaphomyces*) to deer. The name now implies worthlessness or a poisonous character, whilst many fungi so stigmatised are in reality valuable, though neglected, articles of food.

Tobacco, the leaves of several species of the solanaceous genus *Nicotiana*, prepared for use as a narcotic, either by smoking, chewing, or inhaling (as snuff). It is the most widely used of narcotics, its employment in all three ways being made known to Europe by Columbus and the Spaniards between 1492 and 1502. The plant was brought from Mexico to Spain in 1558, and Jean Nicot, French ambassador to Portugal, having sent seeds to Catherine de Medici, the plant has been given his name. Smoking in Europe was mainly the result of English example after Drake's return from Virginia in 1586, and spread rapidly, in spite of James I.'s *Counterblast*, of Papal bulls, of sultans' sentences to death, and of the Russian knout. Most tobacco, and that of the best quality, is the product of *N. Tabacum*, the Virginian tobacco, a coarse-growing, viscid, unbranched annual, six feet or more high, with scattered simple leaves, sometimes two feet long, the upper ones amplexicaul or decurrent, and a panicle of pink flowers with long corolla-tubes. It is the source of Virginian, Cuban, Manilla, Latakia, and Turkish tobacco. *N. rustica*, or Green tobacco, a smaller, much-branched plant, with a shorter, greenish corolla, originally a native of Brazil, is cultivated

in the East Indies: a white-flowered species, *N. repanda*, is said to furnish some of the finest Havannah cigars; and *N. persica*, the tobacco of Shiraz. Tobacco does best with a mean annual temperature not less than 40° F., no early autumnal frosts, and a low rainfall: it is an exhausting crop, requiring abundant manure rich in potassium-nitrate. In Europe it is sown in hotbeds in March, transplanted in May, and harvested in September. Each plant should have from 8 to 12 large leaves. These are gathered when beginning to droop; allowed to wilt, or sweated for three or four days; "cured" either slowly by currents of dry air, or quickly by artificial heat, rising in four or five days to 170° F.; rendered soft by the admission of damp air; stacked and allowed to ferment for from three to five weeks. Tobacco leaves contain 18 to 22 per cent. of ash, principally calcium carbonate, and potassium salts, besides salts of ammonia and nitrates. They have also 25 per cent. of albuminoids; 10 to 14 per cent. of malic and citric acids; 7 or 8 per cent. of cellulose; from 4 to 6 per cent. of resin and fat; about 5 per cent. of pectic acid, and 1 or 2 per cent. of oxalic; acetic acid, increasing during fermentation and reaching 3 per cent. in snuff; from 1.5 to 9 per cent. of the acridly poisonous, colourless, liquid, volatile alkaloid *nicotine* ($C_{10}H_{14}N_2$); and a solid camphor-like substance, *nicotianine*. The nicotine increases in the leaves with age, and is mainly destroyed when the tobacco is burnt, though it also occurs in the remaining oil. The proportion of nicotine determines the strength, but not the flavour, of the tobacco. In snuff the malic and citric acids are largely destroyed, and free ammonia is present, giving the snuff its alkaline pungency. Many habitual smokers find that tobacco relieves bodily or mental fatigue: strong tobacco may undoubtedly produce the disease of the eyes known as amblyopia; and the excessive use of tobacco, especially by the young, seems to affect both the digestion and the nervous system injuriously, inducing more particularly affections of the heart. Most countries have made the cultivation and importation of tobacco a source of revenue. Though it cannot be relied upon as a crop in our climate, its cultivation is chiefly prevented by fiscal prohibitions. During the ten years ending 1881 tobacco was grown on 600,000 to 700,000 acres in the United States, the average annual production being 472,000,000 lbs., the value of which ranged from 40,000,000 to 45,000,000 dollars. During the decade nearly 1,900,000,000 lbs. were manufactured for home use, and over 2,500,000,000 lbs. were exported. In 1890 the crop was valued at £9,000,000 sterling, and the exports at over £5,000,000. England in that year retained for home consumption 56,000,000 lbs. of unmanufactured and over 2,000,000 lbs. of manufactured tobacco, a consumption of about $1\frac{3}{4}$ lb. per head of the population.

Tobas, a South American people still dominant on the banks of the Pilcomayo, Gran Chaco (parts of Bolivia and Paraguay). They are a fierce, savage tribe, much dreaded by all the surrounding populations. All efforts to reduce them have hitherto failed, and in 1882 Crevaux and all his

companions were massacred by the Tobas while attempting to reach Paraguay from Bolivia by the Pilcomayo route.

Tobit, BOOK OF, an apocryphal book of the Old Testament, probably written by a Hellenist of Egypt towards the middle of the 2nd century B.C. It describes the misfortunes, patience, and ultimate deliverance of Tobit, a Jew of the tribe of Naphtali, who had been carried captive to Nineveh. Deprived of the riches he had acquired as a trader through his disobedience to a royal edict which forbade the burial of his countrymen, and reduced to the lowest depths of misery, he sends his son Tobias to Media to demand the repayment of a loan. Tobias, who is protected by the angel Raphael, not only obtains the money, but slays a fish (probably the crocodile) in the Tigris, the heart and liver of which serve as a charm against the demon Asmodeus, whilst its gall cures his father's blindness. From the traces of Zoroastrianism apparent in the tale, it may be gathered that it was based on an Iranian legend.

Tobolsk, a town of Western Siberia, forming the capital of the government of the same name. It is situated at the junction of the Irtysh and the Tobol, 1,535 miles E. by N. of Moscow. The broad regular streets, lined by well-built timber houses, are surrounded by a stone wall, and the appearance of the town from the Irtysh is picturesque. Notwithstanding its distance from the great trade route, it carries on a considerable trade in corn, salt, fish, and timber.

Tocantins, an affluent of the Pará in Brazil, with a northerly course of 1,500 miles. Three hundred miles above its mouth it is joined by the Araguay.

Tocqueville, ALEXIS CHARLES HENRI MAURICE CLEREL DE (1805-59). French economist and political philosopher, was the son of a French peer, and was born at Verneuil. He became a lawyer, and occupied one or two good posts, and in 1831 was deputed to report on the American prison system. The work resulting from that visit was crowned by the Academy, and in 1835-40 his great work, *Democracy in America*, was published. It ran through many editions in different languages, and brought its author many honours, including admission to the Academy in 1841. He became a deputy in Parliament, and in 1849 was Minister of Foreign Affairs. His greatest work is his powerful presentment of *France before the Revolution*, which appeared in 1856, and met with unanimous eulogy.

Todas, aborigines of the Nilghiri uplands, Southern India, now (1894) reduced to 750, but presenting many points of great interest to ethnologists: speak an uncultivated Dravidian language with Telugu and Malayalam affinities; but the type is not Dravidian, being distinguished by tall, robust figures, aquiline nose, retreating forehead, and an extraordinary hirsute development, with full beard, as amongst the Ainus of Japan and many natives of Australia. They are a pastoral people forming two social classes—the *Peikis* or "Sons of God," a priestly order, and the *Katas* or *Tardas*, all the rest. (Caldwell, Hodgson, Marshall.)

Todleben, EDUARD IWANOWITCH (1818-84), the Russian general, was of German descent. After serving in the Caucasus and on the Danube, he gained distinction by his engineering operations at the siege of Sevastopol, during which he was wounded. During the Russo-Turkish War of 1877-78 he conducted the siege of Plevna, and was afterwards put at the head of the army in Bulgaria.

Toga, the distinctive mark of Roman citizenship, was an outer garment of white woollen cloth. It was elliptical in cut, about five yards in length and four in width, and was doubled lengthways in such a manner that one fold exceeded the other in depth. It was worn over the left shoulder, one extremity touching the ground in front, whilst the eleven or twelve feet which remained at the back were gathered up under the right arm and thrown a second time over the left shoulder.

Tokay (NAGY TOKAJ), a small town of Hungary, at the confluence of the Bodrog and Theiss, 130 miles N.E. of Budapest. The rich sweet wine of the name is grown on the volcanic mountain in the neighbourhood, but much of the so-called "Tokay," whether imported from the district or not, is an artificial concoction. The town was burnt down in 1890.

Tokio, or TOKYO (formerly YEDO), the capital of Japan, is situated on the S.E. coast of the island of Nippon or Hondo, at the head of the bay of the same name. The town occupies a broad, fertile plain watered by the river Sumida, but some of the districts (*ku*) are hilly, rising to a height of 100 feet above the general level. It is gradually extending towards the sea, taking in the delta of the river, which is constantly increasing in size. The lower quarters are traversed by a network of canals, crossed by numerous bridges, which form a characteristic feature. On either side of this district are the large and beautiful parks of Shiba and Ueno. The latter park and the Mukojima, an embankment extending for five miles along the river, are famous for their cherry-trees, which in spring-time render them favourite promenades. The imperial palace is an imposing building in Japanese style, surrounded by lofty walls and broad moats. Many of the old residences of the *daimyos* (territorial lords) may still be seen standing in the midst of their large artificial gardens, but others have been replaced by Government offices or new streets of brick houses. Yokohama, the port of Tokio, is connected with the city by a railway, 18 miles in length, and there is another line running in a northerly direction.

Toland, JOHN (1669-1722), the Deistical writer, was of Irish Catholic parentage. He studied at the Scotch universities and at Leyden, and in 1696 published *Christianity not Mysteriorious*. The book aroused much controversy, and was burned by the common hangman in Ireland. Nevertheless, he wrote other works more directly attacking orthodox Christianity, of which *Nazarenus* (1720) was the most remarkable.

Toledo, a renowned but decayed city of Spain, 38 miles S.S.W. of Madrid. It is situated on a group of seven granite hills, 2,400 feet above the sea. Towards the N., the only side on which it is not surrounded by the Tagus, there are inner and outer stone walls, dating respectively from the 7th and 12th centuries, both of which contain several handsome old gates. The houses which line the steep, silent, and gloomy streets are mostly Moorish in style, dating from the 12th, 13th, and 14th centuries. The magnificent cathedral, mainly Spanish Gothic with a semicircular apse, contains some beautiful Flemish stained glass of the 16th century, and the numerous side-chapels are very elaborately ornamented. The Alcazar, the ancient palace of the Gothic kings, rebuilt by Charles V. and Philip II., was burned down in 1887. The manufacture of the famous Toledo swords is still carried on a short distance to the N.W. Toledo, the Roman *Toletum*, was the capital of the Visigothic sovereigns. It was occupied by the Saracens and Moors from 714 to 1085, when it became the capital of Castile and Leon.

Toledo, a city of Ohio, on the Maumee, United States of America, about 5 miles above the western extremity of Lake Erie. Its excellent harbour, its situation on the Miami and Erie Canal, and the railways branching out in all directions, make it an important commercial centre. There are also waggon-works, foundries, and other manufactories.

Toleration Act, an Act of Parliament passed May 24, 1689, relaxing the stringent conditions of the Act of Uniformity, the Five Mile Act, and the Conventicle Act. Freedom of worship was now secured for those who would take the oath of allegiance and subscribe the declaration against Popery, but Dissenting ministers were required to subscribe the Thirty-nine Articles, except three and part of a fourth. Quakers were exempted from these conditions. The benefits of the Act did not extend to Roman Catholics and Unitarians or Deists.

Toll, an old term for a tax in general, but restricted in later times to the payment exacted in return for a privilege. Market-tolls, raised by the owners of the land, were formerly common, but the only tolls known in recent times have been those collected on roads and other accommodations for transport. Toll-bars on roads were finally abolished in England in 1889, but the system is still maintained on piers, and to some extent on bridges also.

Tolstoi, COUNT LEO NIKOLAIEVITCH, was born in 1828 in the government of Tula. After a period of student life at the university of Kazan, he served in the army in the Caucasus, Turkey, and the Crimea during the war. His earlier books were written in the Caucasus (*The Cossacks*, etc.). After his retirement from the army, he visited Germany and Italy, and finally settled down on his estates, working with his own hands among his tenants, whose life he endeavours fully to share. His two greatest works are *War and Peace* (1865-68) and *Anna Karenina* (1875-78). His subsequent works

are all highly didactic, and advocate that stern asceticism which Tolstoi believes to be the root principle of true Christianity. Matthew Arnold considered him one of the greatest European writers of his age.

Toltecs (TULTECS), a historical people of Nahuatl stock, Mexico [NAHUA], who, according to the national traditions, flourished from the 6th to the 11th century, when their power and culture were destroyed by the irruption of the barbarous Chichimecs. During the Toltec period the Nahuatl civilisation reached the high-water mark of excellence, so much so that the term *toltecatl* afterwards became synonymous with artificer or builder, and to the Toltecs were attributed all the great monuments of the Mexican plateau and many even of Central America. Hence it has been argued that there never was a Toltec people at all, and that the word originally designated nothing more than the first and most flourishing epoch of Nahuatl culture before the centre of their power was removed from Tollan (Tula), 50 miles farther south to the site of the present city of Mexico. There was also a Tula in Nicaragua founded by the Nahuatl Toltecs, who took refuge in Central America, and for a time revived the glories of the old Toltec state after its overthrow by the Chichimecs. The Toltecs are said to have possessed vast libraries of pictorial writings, destroyed by their Aztec descendants, who were jealous of the glory of their renowned predecessors. (Valentini, *The Otmeccas and the Tultecas*; Brinton, *Were the Toltecs an Historical Nationality?*)

Tolu Balsam is a thick yellow or brown liquid obtained from *myroxylon toluiferum*, and other trees. It dries to a hard, yellow transparent solid, which, like the liquid balsam, possesses a fragrant, agreeable odour. It contains benzoic and cinnamic acids, together with derivatives of these compounds and resinous substances. It is used slightly in medicine as a stimulant and pectoral.

Toluene (C₇H₈) is a hydrocarbon which is derived from benzene (q.v.) by the replacement of one of the hydrogen atoms by the group CH₃. It is a liquid which in most of its properties closely resembles benzene. It boils at 110°, and has a specific gravity 0.88. By oxidation it is converted into benzoic acid. It occurs in, and is chiefly obtained from, coal-tar, and is also a product of the distillation of Tolu Balsam and other aromatic compounds.

Tomato, or LOVE-APPLE (*Lycopersicon esculentum*), an annual herbaceous plant, native to South America, probably Mexico, belonging to the order Solanaceæ, cultivated in Europe, for the sake of its wholesome fruit, since the beginning of the 16th century. It has irregularly pinnate leaves; extra-axillary, many-flowered inflorescences; connate anthers dehiscing by longitudinal slits; and polished, scarlet or yellow, many-seeded fruits. The flowers are often fasciated so as to produce a many-chambered, irregularly-lobed fruit; but two varieties in which there are only two carpels, *L. e. cerasiforme*, with a round, cherry-like fruit, and

L. e. pyriforme, pear-shaped, have sometimes been considered specifically distinct. The consumption of this valuable acidulous fruit in England is on the increase, about 1,000 tons being sold annually. It will not always ripen out of doors in this country, but large quantities are forced, in addition to the much larger quantities imported, both fresh and in tins, from America and the Continent. It is eaten raw in salad, cooked with meat, or as a sauce or ketchup.

Tombac is an alloy of copper and zinc, but with a much greater quantity of the latter metal than is present in ordinary brass. It is a yellow, tough alloy, which may be whitened by the addition of nickel or arsenic.

Tomicus, a genus of bark-beetle, of the family Scolytidæ, which burrows under the bark of trees.

Tom-Tit. [TIT.]

Ton is the same word as "tun," and may have been derived, through the Latin, from a Greek word denoting a vessel for wine, or may be merely derived from the verb *tynan*, "to enclose." The word exists under different modifications in most European languages. The ton is a mass of 20 cwt. or 2,240 lbs. in this country, but in some places the hundredweight is reckoned as only 100 lbs., which reduces the ton to 2,000 lbs. The tun was long used as a measure of wine and beer; in the case of the former it consisted of 252 gallons, while a tun of beer held 216 gallons. The gallon itself, however, varied in the two cases, so that the curious result was obtained that a tun of beer was actually a greater volume than a tun of wine. These measures are now only used for the sake of convenience, the standard gallon being the highest legal measure of volume.

Tone, THEOBALD WOLFE (1763-98), one of the leaders of the United Irishmen, was the son of a Dublin coachmaker. Soon after being called to the bar, he gave himself up to political intrigue in connection with the Catholic Committee. On account of his share in the United Irishmen organisation he had to go to America. Thence he undertook a mission to France in order to get French help for them, and he himself served under Hoche. In 1798, having been captured on board a French squadron, he was condemned to death, but anticipated his fate by strangling himself. (See his *Autobiography*, new edition, 1892.)

Tongking, or TONQUIN ("Eastern capital"), is properly the name of the town of Hanoi (q.v.), but it now denotes the part of Annam (q.v.) which extends from 18° N. lat. to the borders of China. This district, which occupies the alluvial basin of the Songkoi or Songea river, and has an area of 34,700 square miles, was in 1884 annexed by France. The most important product is rice.

Tongue. The tongue is mainly composed of muscular tissue, and is covered with mucous membrane, which presents a remarkable development of the structures known as papillæ. These papillæ are of three kinds—the *circumvallate* papillæ are

situated in two V-shaped lines at the base of the tongue, and consist of eight or ten rounded elevations, each of which has a central depression; the *fungiform* papillæ are distributed mainly over the tip and sides of the tongue; the *filiform* papillæ, simple conical elevations, are numerous distributed over the whole surface of the tongue. The tongue is possessed of ordinary sensibility, and contains the nerve terminations concerned with the special sensations of taste (q.v.); it plays, moreover, an important part in the modification of speech sounds and in the muscular actions of mastication and swallowing.

Diseases of the Tongue. The mucous membrane of the tongue is apt to be affected by inflammation or *glossitis*, and in this form of disease the deeper parts of the tongue are sometimes involved, leading, it may be, to abscess formation, or, in rare instances, to permanent hypertrophy of the organ. White patches are sometimes met with on the surface of the tongue, a condition known as leucoplakia. Ulceration of the tongue occurs in connection with digestive disturbance and with syphilis, or from the irritation caused by a sharp edge of an injured tooth. The tongue is an organ which is not uncommonly affected by the form of cancer known as epithelioma.

Tonics are remedies which favourably influence the nutrition of the body, improving appetite and digestion. Change of air, exercise, and baths are among the most valuable tonic remedies. Certain drugs possess tonic properties, either in virtue of their action upon the digestive system, as in the case of calumba, gentian, quassia, and the like, or by their influence in improving the condition of the blood (preparations of iron having a remarkable influence of this kind), or by their general effect as "alteratives" and general tonics, producing improvement of nutrition, such as is manifested on the exhibition of remedies like cod-liver oil, arsenic, or quinine.

Toning. The photographic prints obtained upon the ordinary silver paper of photographers have neither a permanent nor pleasing colour, and have therefore, before fixing, to be subjected to a process known as toning. This is usually effected by immersing the prints for some time in a bath containing a solution of chloride of gold and other salts, *e.g.* sodium acetate or borax. The colour of the print is seen to alter and pass through a series of colour from brown to a deep purple, the paper being taken out when the desired tone is obtained. The exact tone obtainable, however, varies with the paper and the composition of the toning-bath, and a considerable amount of experience is required to obtain the best results. The prints are afterwards washed and fixed by immersing in a solution of sodium thiosulphate. The exact chemistry of the process is still a matter of some uncertainty. It is usually regarded as dependent on a substitution of gold for the silver of the image. Many other solutions, however, may be used for toning, as solutions of platinum, ammonium sulphide, iron, etc., and it may be due, in some cases, to an alteration of the molecular state of the silver deposit.

Tonka Bean, corrupted into **TONQUIN BEAN**, the seed of the leguminous *Dipterix* (*Coumarouna*) *odorata*, a large tree native to Cayenne. Both fruit and seed resemble those of the almond, but the seed is longer, black, and polished. It contains a crystalline aromatic substance, *coumarin* ($C_9H_6O_2$), which has the scent of new-mown hay. It is used to scent snuff and in the manufacture of sachets and perfumes, for which purpose it is imported from Pará, Angostura, and Surinam.

Tonnage, a measure for determining the cubical capacity and carrying-power of ships and thus estimating the dues on shipping. The "register" ton now in use was enforced by the British Merchant Shipping Act of 1854, amended in 1862 and 1867, and has been adopted by various foreign countries. It is equivalent to 100 cubic feet of space, so that a vessel with an internal volume of 100,000 cubic feet is 1,000 tons register. The Act makes provision not only for ascertaining the depth of a ship in addition to its length and breadth, but for taking into account the curvature of the hull by means of cross measurements at various points. A deduction is made for crew-space, and on steamers for the engine-room, boilers, etc. On the other hand, the poop and other closed-in spaces above the upper deck available for stowage are added to the "nett register" tonnage.

Tonsillitis (QUINSY). Inflammation of the tonsils often results from exposure to cold or wet, and when the tendency to this form of mischief becomes developed in early life the disease is apt to recur from time to time. An attack of tonsillitis is usually ushered in by marked febrile disturbance, and the temperature may attain a considerable degree of elevation, one or both tonsils become swollen, there is marked difficulty in swallowing, tenderness behind the angles of the jaw, the tone of the voice is altered, and there may be deafness. Sometimes a collection of matter forms in the substance of the tonsil, and in such cases the symptoms are very distressing to the patient until such time as the abscess bursts. The treatment of tonsillitis consists in maintaining rest, giving nutritious liquid food, causing the patient to gargle (in the early stages with warm milk or black currant tea, later with some form of astringent gargle), and administering tonics. During convalescence it is important that a liberal diet should be administered, and port wine may often be taken with advantage. In cases where the tonsils become permanently enlarged as the result of repeated attacks of inflammation, it is usually advisable to have the hypertrophied structures removed.

Tonsils. The tonsils are situated one on each side of the throat between the anterior and posterior pillars of the fauces. Each tonsil consists of a collection of adenoid or lymphoid tissue, and is covered with a mucous membrane, which presents a number of orifices leading into recesses called the crypts of the tonsil.

Tontine, a society formed for raising money for some definite purpose, the lenders receiving interest for their loan, and an indefinitely increasing

interest in proportion to those who survive the other members of the society. In this latter respect a tontine somewhat resembles a lottery, though some hold that it is no more a lottery than is an ordinary assurance society. But in the case of an assurance society the death of the assured is certain, the only element of chance being whether the assured can keep the premium paid, and how many premiums he has to pay before his representatives become entitled to the sum assured; whereas in the case of a tontine the increase of income is altogether a matter of chance in any particular case. The name is derived from a Neapolitan banker named Lorenzo Tonti, who settled in Paris, and in the year 1653 proposed to raise a huge loan for the national exchequer upon a new principle. His idea was to issue 300 francs shares and to divide the subscribers into ten classes—i.e. those under 7 years of age, those from 7 to 14, 14 to 21, etc. Each class was to divide a fixed proportion of interest among its members, and, as the members of a class died off, the survivors became entitled to all interest due to the class; and upon the death of the last member of the class the profits of that class passed to the State. This scheme fell through, partly through national prejudice against Tonti and his patron Mazarin, who were both Italians; but in 1689 Louis XIV. established a tontine to last 40 years, and in 1736 the last survivor was drawing 73,500 francs as interest upon her 300 francs share. Many such societies have been started in France, and the principle has been introduced into Great Britain and Ireland. In the United States it has also been popular. In 1871 such a society was proposed for the acquisition and management of the Alexandra Park and Palace. The principle has also been applied to the formation of clubs, the survivors becoming proprietors.

Tooke, JOHN HORNE (1736–1812), was born in Westminster, and educated at Eton and Cambridge. He became successively law-student, usher, and clergyman. Having made the acquaintance of Wilkes, he began to take an active part in politics, and in 1773 resigned the living of New Brentford. He was imprisoned for getting up a subscription for the Americans who fell at Lexington, and in 1794 was tried for high treason but acquitted. In 1801 he obtained a seat in Parliament. In 1782 he adopted the name of Tooke, having been hitherto known as "Parson Horne." His *Diversions of Purley*, amongst its other contents, has the best philological work of the 18th century.

Toole, JOHN LAWRENCE, the comedian, was born in 1832. Having played successfully in the country, he made his *début* at the St. James's Theatre in 1854. He was afterwards connected with the Lyceum, the Adelphi, and the Queen's in Long Acre. Since 1879 he has been his own manager, but has always continued to act his favourite low-comedy parts.

Tooth, Toothache. [TEETH.]

Tooth-Shells, the shells belonging to the class Scaphopoda, of which the genus *Dentalium* (q.v.) is the only well-known form. *Cadulus* and *Siphono-*

dentalium are two other living genera, the latter of which dates back to the time of the Chalk.

Topeka, the capital of Kansas, United States of America, is situated on the Kansas river, 67 miles W. of Kansas City. There are several handsome public buildings, including a State Capitol and a State asylum for the insane. The town contains railway-shops and other manufactories.

Toplady, AUGUSTUS MONTAGUE (1740–78), the hymn-writer, was born at Farnham. In 1768 he obtained a living in Devonshire, but in his later years preached at a chapel in London. In 1776 a collection was published called *Psalms and Hymns*, some of the latter, including *Rock of Ages*, being by Toplady himself.

Top-Shells, the members of the family *Trochidae*. They are small univalve shells, which are largely used for ornamental purposes, as the shell is composed of nacreous material which appears pearly when the outer layer is removed by acid. The type-genus *Trochus* ranges from the Silurian period to the present day.

Tormentil (*Potentilla Tormentilla*), a very common trailing-plant on heathy ground, with quinate lower leaves, ternate upper ones, and four yellow petals.

Tornado is a local disturbance generally extending over a small area, but exceedingly destructive and generally accompanied by violent hailstorms, thunder, or waterspouts. Tornadoes are by no means all equally violent, but all—even the mildest—are characterised by a rotatory motion, hence the name tornado. When at any time the atmosphere at any spot is in a state of instability and a stream of hot air from below forces its way through the cool layers above, we have the possibility of a tornado. The place of the rising stream is filled by air rushing in from all surrounding parts, and a vertical circulation will continue so long as the initial cause of the instability is maintained. The vertical motion may extend for several miles in height, but the horizontal effect is seldom felt over a distance of more than half a mile. The temperature of the rising current exceeds that of the air immediately surrounding it, and its pressure is proportionately less; if the cause of the disturbance reaches high altitudes, the excess of temperature of rising over the surrounding air increases, and the vertical circulation extends to a great height. There is a certain point reached by the ascending current, where its temperature has become equal to that of the air outside it; and if the vertical circulation were the only active motion, the pressure of the two portions of the atmosphere would also be equal there. Up to this point a constant impetus has been given to the ascending current, owing to its density being less than that of its neighbouring fluid. Consequently the velocity has increased, but with a diminishing acceleration. Above this level, however, the rising current becomes denser than the air around it, and therefore its upward velocity is retarded. It meets, as it were, with a resistance to its passage, and

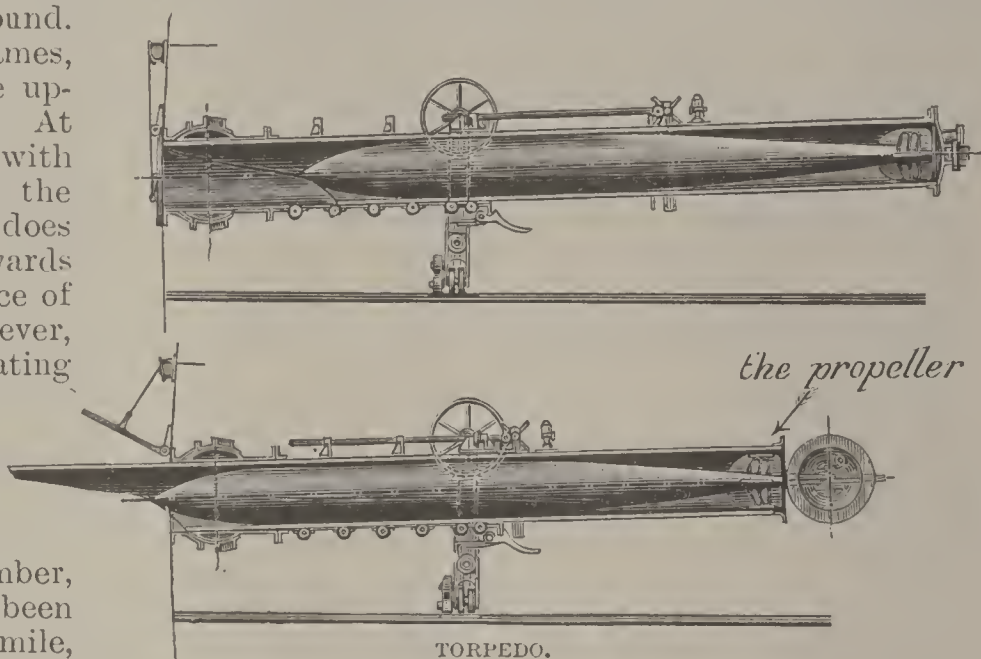
consequently often spreads out horizontally on all sides. It is seldom, however, that the air surrounding this vertical disturbance has been perfectly free from motion, and the slightest rotatory movement in the in-rushing air at the base of the column is sufficient to produce a gyratory circulation in the whole uprising stream. A spinning column of air is thus produced. The whirling of the air has an enormous effect on the pressure, and causes it to be extremely low in the centre of the tornado, while it rises rapidly towards the outside. This causes many curious effects in the passage of a tornado. The door of a closed room is suddenly confronted with the centre of the column; the pressure on the outside of the door is therefore suddenly diminished, but the air inside exerts its pressure as usual, and the result is that the door is burst open outwards. In the same way the walls of feeble houses are projected prostrate on the ground. Windows burst and leap from their frames, while the lid of a box will suddenly rise upwards as though gravitation had stopped. At the base of the rotating column friction with the earth's surface greatly diminishes the gyratory motion; hence centrifugal force does not make these warmer particles rush outwards sufficiently forcibly to prevent the entrance of the surrounding air. Higher up, however, friction has little or no power. The rotating particles push back the outside air, and thus form an impenetrable wall for the whirling pillar. This naturally increases the force of the inrush from below, and places enormous power in the possession of the ascending current. Pieces of timber, weighing several hundred pounds, have been lifted above the houses for a quarter of a mile, trees have been wrenched up by the roots, horses and waggons lifted into the air, houses turned about, engines overturned, and rails torn up from the ground, while even the wool and feathers of living sheep and birds were not insignificant enough to elude the vigilance of this devastating monster. Tornadoes are specially violent in the United States, and the Signal Service has published exhaustive and interesting accounts of many of them, Paper No. 4 by Lieutenant Finley dealing graphically with the fearful results in Kansas, Nebraska, Missouri, and Iowa caused by the memorable tornado of May 29 and 30, 1879. The reader is referred to Ferrel's *Popular Treatise on the Winds* for further information on this wonderful phenomenon.

Toronto, the capital of the province of Ontario and second city of Canada, is situated at the mouth of the Don on the N. side of Lake Ontario. It stands beside a large bay sheltered by a sandy peninsula, 6 miles in length, which forms an excellent harbour. Among the many handsome public buildings Osgoode Hall, in which the superior law-courts are located, the custom-house, the post-office, and the official residence of the Lieutenant-Governor are especially noteworthy. The University of Toronto, which was destroyed by fire in 1890, is now in course of reconstruction. There are several other educational establishments. Its rapid pro-

gress has been due mainly to its position in the midst of a rich agricultural district with every facility for the navigation of the lakes. In 1793 its site was occupied by a single wigwam, and the population increased from less than 10,000 in 1834 to over 180,000 in 1891.

Torpedo, genus of Batoid fishes, type of a family (*Torpedinidae*), containing the Electric Rays. *T. hebetans* occurs on the south coast.

Torpedo is an appliance for exploding a charge of gun-cotton or dynamite near a vessel, and may be fixed—in which case it is usually known as a submarine mine—or may be provided with some means for propelling it in any direction. A torpedo of the former class consists of an iron vessel containing from 30 to 500 lbs. of explosive, either moored so as to float some 10 feet below the



surface, or resting on the bottom. A mine may be arranged to explode when struck by a ship, or may be controlled electrically from the shore. In the latter case the firing key which closes the circuit and explodes the charge, must be pressed when the ship is over the mine, and to ascertain when this moment arrives two sights or telescopes are arranged so that the lines of vision of two observers cross at a point over the mine; when the ship is sighted by both observers it is known to be in the desired position. In some cases a current from a battery on shore is taken by an insulated wire to the mine, and the circuit is automatically closed when the mine is struck by a vessel, while the safety of friendly ships may be secured by disconnecting the battery on shore. Of the numerous types of locomotive torpedoes, the Whitehead is the only one of any great importance. It is practically a submarine boat, shaped like a cigar, and from 12 to 19 feet in length. It is propelled by a three-cylinder engine, supplied with compressed air from a chamber provided for that purpose. The nose of the torpedo contains a charge of from 30 to 100 lbs. of gun-cotton, and is provided with a mechanical arrangement for exploding it on contact with the side of a ship. By means of a secret piece of mechanism, two horizontal rudders adjust themselves so that the

torpedo maintains a fixed distance below the surface; it can travel some 600 yards at a speed of 24 knots.

Torquay, a watering-place of recent growth, situated on the S. coast of Devonshire on the N. side of Tor Bay. The pleasant alternation of hill and valley and the abundant and luxuriant foliage which relieves the streets and terraces give it a very picturesque appearance. Owing to its mild and equable climate it is much frequented by consumptive patients, especially during the winter months. The harbour is usually crowded with yachts. There are marble and terra-cotta works of some repute in the vicinity.

Torque, a kind of bracelet or armlet, generally of gold, and often formed of a spirally-twisted bar or bars, ending sometimes in hooks, sometimes in serpents' heads. They were greatly in use in ancient times in Asia and in Northern Europe, and the Romans adopted the practice of wearing them after their contact with Celtic and Oriental races. Specimens have been dug up in many places, as well in the United Kingdom as abroad.

Torquemada, THOMAS DE (1420-98), the first head of the Inquisition in Spain, was a native of Valladolid. Before his appointment in 1483 as Inquisitor-General, he had been a prior of a Dominican house at Segovia. He died at Avila.

Torricelli, EVANGELISTA (1608-47), mathematician and natural philosopher, was born at Piancaldoli and educated by the Jesuits. In 1641 he was appointed mathematician to the Grand Duke of Tuscany in succession to Galileo. From his discoveries in connection with the barometer that instrument has been called the Torricellian tube, and its vacuum the Torricellian vacuum. He also laid down the primary principles of hydromechanics, and made many discoveries in pure mathematics. His *Trattato del Moto* (*Treatise on Motion*) appeared about 1641.

Torridon Sandstone, a series of reddish and chocolate sandstones, at least 8,000 feet thick, resting nearly horizontally upon the Archaean gneisses near Loch Torridon in Ross-shire, and apparently of Cambrian age.

Torsion is the strain set up in a rod or wire when one end is twisted with regard to the other. By considering the relative positions of two adjacent sections of a bar before and after twisting, it is clear that this strain is a shear strain. If a twisting movement or torque be applied to one end of a bar, whose other end is fixed, it is found that the twist produced is proportional to the torque, provided the limit of elasticity be not exceeded. In the case of bars of the same material and section but of different lengths, the twist for the same torque is proportional to the length; and in round bars of the same length, but of different diameters, it is inversely proportional to the fourth power of the diameter. In the case of bars or wires of the same length and diameter, but of different materials, the twist produced by a given torque is inversely proportional to the modulus of rigidity of the material—that is, to the ratio of the shear stress to

the shear strain produced. The twist produced by a given torque applied to bars of different shapes depends upon the section. The fact that the angle through which the free end of a wire is twisted is proportional to the torque affords a convenient means of measuring twisting forces, and is used in a variety of instruments, such as the *torsion balance*, by means of which Cordoub investigated the laws of electric and magnetic attraction. A little consideration will show that when an ordinary spiral spring is altered in length, the wire of which it is made is subjected to torsion, and such a spring obeys the same laws as a twisted wire, due allowance being, of course, made for the diameter of the mandrel on which it is wound.

Torsk (*Brosmius brosme*), a valuable food-fish of the Cod family, from the North Atlantic, its southern limit being the Firth of Forth. The length averages from 20 inches to three feet, and there is a single barbule under the chin. An allied species (*B. flarescens*) with two barbules is taken on the American coast.

Tortoises and **Turtles** constitute the Reptilian order Chelonia, well marked off from all the other orders by the possession of a dorsal shield, or carapace, and a ventral shield, or plastron, united at the sides, and forming a kind of case, within which the head and neck, limbs (of which there are always two pairs fitted for walking or swimming), and tail can be completely or partially retracted. The carapace is usually covered with hard horny plates called tortoise-shell. The jaws are toothless, and covered with horny sheaths, like the bill of a bird. There are two sub-orders:—1. *Athecata*, in which the carapace is flexible, with but one living form, the Leathery Turtle (*Sphargis coriacea*), which has a wide range in temperate and tropical seas, and is said to live entirely on marine vegetation. It sometimes attains a length of six feet, and the carapace is marked by seven grooves running backwards from the head. 2. *Testudinata*, in which the carapace is hard and rigid. These are generally divided into four families. (1) *Cheloniidæ*, exclusively marine, with the shields of the carapace partially ossified and the feet large and fin-like. They are natives of intertropical seas. The two most important forms belong to this family—the Green Turtle (*Chelone viridis*) from the Atlantic, the most highly prized of those used for food, and the Hawk's-bill Turtle (*Caretta imbricata*), from the Indian and Pacific Oceans, from which is obtained the tortoise-shell of commerce. (2) *Testudinidæ*, the Land Chelonians. One of the best-known forms is the Common Greek Tortoise, often hawked about the streets of London and other large towns. To this family belong the gigantic tortoises of the Galapagos. These attain a length of about three feet. They are rapidly becoming extinct, owing to the fact that their flesh is excellent eating, and that a valuable oil is prepared from their fat. (3) *Chelydidæ*, containing forms frequenting marshes and fresh water. To this family belong some European forms and the terrapins of America. (4) *Trionychidæ*, fresh-water turtles, carnivorous in habit, having the carapace covered

with soft skin. The webbed digits end in sharp claws. The name "tortoise" appears to have been originally applied to terrestrial, and "turtle" to marine forms; but, though apparently so different, the origin of both words is the same. The meaning is "the animal with twisted feet." The commercial product has always been known as "tortoise-shell," though obtained from a marine chelonian. It is used for combs, jewellery, and inlaying, but much less extensively than formerly, perhaps because it is so easily imitated.

Total Reflection. When a ray of light passes from one medium, M , into a denser medium, M' , it is bent in towards the normal to the dividing surface. [REFRACTION.] The ray is naturally bent away from the normal when it passes from M' to M . The incident ray, IO , will therefore be bent into the position OR . As the angle, ION , is increased, OR makes a smaller and smaller angle with the surface, until when the incident ray is in a certain position, $I'O$, the refracted ray is *in* the surface (OR'). Upon inclining $I'O$ still more to the normal we fail to get any refracted ray at all—all the light obeys the laws of reflection—and it is said to be *totally reflected*. If M be air and μ the index of refraction from air to M' , then $\frac{1}{\mu}$ is the index of

refraction from M' to air. Therefore, $\frac{1}{\mu} = \frac{\sin ION}{\sin RON'}$ and total reflection begins when RON' has become $R'O N'$, i.e. 90° . Hence, $\frac{1}{\mu} = \sin I'O N$. This angle is called the *critical angle*. Hence, the sine of the critical angle is the reciprocal of the index of refraction of the medium, and total reflection occurs when incident rays from the denser medium meet the surface at any angle greater than this critical angle.

Totem, a North American Indian term, with the meaning of "family mark," though some tribes have different words with the same signification. When first used as an English word "totem" seems to have had the meaning of some mythic animal-ancestor, from which a North American family or clan claimed descent. It occurs in this sense in the *Song of Hiawatha* (xiv.), where Hiawatha teaches his people the art of picture-writing. He says of the long-dead warriors and hunters—

"Of what kin they are and kindred,
From what old, ancestral Totem,
Be it Eagle, Bear, or Beaver,
They descended, this we know not."

And he bade his tribesmen adorn their grave-posts with the inverted totems of the dead who slept beneath. It is, of course, well known that this poem is founded chiefly on Schoolcraft's collection of Indian legends. A totem was generally some animal whence the clan was supposed to have descended, and was used as token or emblem by all the members of the clan, its figure being often tattooed on the body. The totem had a religious significance, that is, the totem-animal was in many cases, if not in all, considered as the representative or embodiment of a deity specially favourable to the clan, and a man was prohibited from killing or

injuring any animal of the species to which his totem was belonging. Thus to the man whose totem was a bear or a beaver, all bears or beavers were in some way sacred; and thus, as Andrew Lang suggests, animal-worship may have arisen. Totemism also had an important bearing on marriage, for no man might marry a woman of the same totem as himself, and so, perhaps, grew up the practice of exogamy or marriage out of the tribe. Besides clan-totems, there are personal totems peculiar to an individual, the subject of special revelation during the ceremonies of initiation at manhood. Totemism is by no means confined to the Indians of North America; it is still found in Australia and Africa, to a less extent in India, and at one time or other has had a wide range over the globe.

Totemism. [TOTEM.]

Totonacs, a Mexican people of the Sierra de Huachinango, states of Puebla and Vera Cruz, traditionally from the Anahuac tableland, whence they were driven east by the Chichimecs and Aztecs some centuries before the arrival of the Spaniards; appear to be a branch of the Maya family, closely related to the neighbouring Huastecs of Vera Cruz. The Totonacs were one of the civilised peoples of the New World, and to them are attributed several monuments, such as the two pyramids of Teotihuacan. Zempoala, centre of their power, was reduced by Montezuma a short time before the arrival of the Spaniards. The Totonacs, that is, "Three Hearts," so called from the hearts of three youths, triennially offered to the gods in pagan times, still number (1893) about 90,000, all nominal Christians.

Toucan, any bird of the Picarian family Rhamphastidæ, from tropical America. They live in the depths of the forests, among the branches of trees, and their diet is almost exclusively fruit,



TOUCAN.

though in captivity they are not fastidious. The bill is long and wide, curved above, and compressed from side to side, and notched at the edges; the tongue is long and feathered. There are five genera; *Rhamphastos*, containing the true

Toucans, with twelve species, ranging from Mexico to the south of Brazil. The general hue of the plumage is black, with white or scarlet on the neck. The bill is also brightly coloured, and Waterton was probably the first to devise a plan by which this colouring might be preserved after death. The genus *Andigena*, from the South American Andes, contains the Hill Toucans, soberly clad in grey; the species of *Aulacorhamphus*, ranging from Mexico to Peru and Bolivia, have green plumage; and the Toucanets (*Selenidera*), from Veragua to Brazil, east of the Andes, resemble the species of *Pteroglossus*. [ARAÇARI.]

Touch. The sense of touch is usually said to include what is known as ordinary tactile sensibility, the sense of pressure, the sense of temperature, and pain. Tactile sensibility is possessed in greater or less degree by all parts of the skin. In some places, *e.g.* over the heel (where the epidermis is very thick), the tactile sense is dull; while in other parts, such as the tips of the fingers, and particularly the tip of the tongue, it is much more acute. In some instances certain end-organs of nerves appear to be concerned in transmitting tactile sensations. Such special end-organs have been already alluded to under the heading NERVE. In other instances no such special organs can be detected, the nerve-fibres simply breaking up at their terminations into a plexus of fibrillæ. In estimating the degree of tactile sensibility of different parts of the body it is customary to ascertain the least distance at which the two points of a pair of compasses can be separately distinguished. This distance in the case of the tip of the tongue does not exceed $\frac{1}{24}$ of an inch, while in the middle of the back it is as much as $2\frac{1}{2}$ inches.

Touch-Paper is prepared by soaking paper in a solution of nitre, and allowing it to dry. When ignited it does not burst into flame, but smoulders slowly with a small red edge until completely burnt. It is hence largely used as a fuel for the ignition of powder, fireworks, and in blasting, etc., as it gives the operator sufficient time to retire to a safe distance before the explosion.

Touchstone is a hard black rock employed to roughly determine the composition of gold alloys. Black basalt and dark quartzose rocks may be employed. The alloy is drawn over the surface and leaves a streak, the colour of which varies with the proportion of gold, and which is compared with the streaks made by alloys of known composition.

Toulon, an important French fortress and naval port in the department of Var, 42 miles E.S.E. of Marseilles. It stands on the N. side of a deep bay opening into the Mediterranean, and towards the N. and W. is sheltered by lofty hills. The whole of the Darse Neuve (or new dock) and one-third of the Darse Vieille (or old dock) are appropriated to the French navy. Adjoining the Darse Neuve are the dockyard, 240 acres in extent, and the magnificent arsenal, which covers 4 miles. The fortifications have been strengthened at various times during the present century. Toulon is the Roman *Telo Martius*.

Toulouse, a French town, *chef-lieu* of the department of Haute-Garonne, situated on the Garonne, 160 miles S.E. of Bordeaux. Three bridges, one of which (the Pont Neuf) is a handsome structure of seven arches dating from the 16th and 17th centuries, connect it with the suburb of St. Cyprien. On the E. and N. are the Canal du Midi, connecting the Garonne with the Mediterranean. The greater part of the town consists of narrow, ill-paved streets, but there are some fine mansions of the 16th and 17th centuries. The principal buildings are the cathedral, the large church of St. Sernin (part of which dates from 1096), the Capitole, or town hall, and the Musée, which contains a good collection of antiquities. The university ranks third amongst those in France. The manufactures include silk and woollen stuffs, leather, steam-engines, and brandy. Toulouse, the Roman *Tolosa*, became the capital of the Visigothic kingdom, and was afterwards ruled by Counts, who were practically independent from the 10th to the 13th century; but on the death of Joan, daughter of Raymond VII., in 1271, his territory was incorporated in the dominions of the French sovereign.

Touraco, or PLANTAIN-EATER, any bird of the African genus *Turacus*, with sixteen species. They are fruit-eating birds, with short high bill, notched in both mandibles, an erectile crest, and green plumage, with some purple on the wings and tail.

Tourgenief. [TURGENIEF.]

Tourmaline, a complex mineral silicate of alumina, with magnesia, boric acid, and smaller proportions of phosphoric acid, iron, manganese, calcium, potassium, sodium, lithium, fluorine, and water. Its composition may approximately be represented by the formula $3\text{RO} \cdot \text{SiO}_2 + \text{R}_2\text{O}_3 \cdot \text{SiO}_2$. It crystallises in the Hexagonal system, generally in long three- or six-sided prisms, hemimorphically terminated. It also occurs in needles, sometimes radiating. It has a sub-conchoidal fracture, a hardness of 6.5–7.5, a specific gravity of 3–3.3, and a vitreous lustre. It is very variable in colour, being most commonly black and opaque (*schorl*); but sometimes transparent and rose-red (*rubellite*), blue (*indicolite*), green, yellow, brown, or colourless. Its crystals are sometimes banded or particoloured, the pink-and-green specimens from Paris, Maine, U.S.A., being among the most beautiful of American minerals. The transparent varieties when flawless are classed as precious stones, the blue being an excellent substitute for sapphire. Tourmaline is strongly doubly-refractive and pleochroic, the ordinary ray being so completely absorbed that a plate of one of the more translucent varieties, cut parallel to the chief axis of the crystal, acts as a polariser. Two such plates, suitably mounted, form the simple polariscope known as *tourmaline tongs*. When rubbed tourmaline becomes positively electric; and when heated or cooled the differently terminated ends of its hemimorphic crystals exhibit opposite alternations of electric polarity. Schorl is common in granite, gneiss, schists, and crystalline limestones; with quartz it forms *tourmaline rock*; and with orthoclase the beautiful

black-and-pink *luxullianite* (named from the village in Cornwall near which it occurs) of which the Duke of Wellington's sarcophagus is made.

Tournay, or TOURNAI (Flemish *Doornik*), a Belgian town in the province of Hainault, 45 miles S.W. of Brussels. Seven bridges cross the Scheldt, on either side of which extend broad quays planted with trees. The newer part of the town has a very neat appearance. Boulevards now occupy the site of Vauban's fortifications. There is a fine Romanesque cathedral, with paintings by Flemish masters. The principal manufactures are stockings and Brussels carpets. Tournay is believed to be Cæsar's *Civitas Nerviorum*. In the 5th century it became the capital of the Franks. In the Grande Place is a statue of the Princess d'Épinoy, who held the town against Alexander of Parma in 1581.

Tourneur, CYRIL, an English dramatist of whose life very little is known, died in Ireland in 1626. He seems to have served for a time as a soldier. He is remembered by two plays somewhat in the manner of Webster, *The Atheist's Tragedy*, and *The Revenger's Tragedy*. In 1872 *The Transformed Metamorphosis*, a satire in verse by the same writer, was discovered.

Tourniquet, an appliance used for the purpose of subjecting an artery to pressure, with a view to checking loss of blood in surgical operations, or controlling the flow of blood in the treatment of aneurism.

Tours, a French town, formerly capital of the province of Touraine, and now of the department of Indre-et-Loire, situated on the left bank of the Loire, 147 miles S.W. of Paris by railway. It is a singularly handsome town, and stands in the midst of a fertile and beautiful district. The fine cathedral ranges in date from the 12th to the 15th century, with two towers over 200 feet in height, added during the Renaissance period; it contains some magnificent old painted glass. The church of St. Julien and the Archbishop's palace remain, but the greater part of the abbey-church of St. Martin was destroyed during the Revolution. There is a library, with 50,000 volumes and 1,200 MSS. The trade is considerable, and there are silk-mills and printing works. The town is also noted for its confectionery. It takes its name from the Turones, of whose country it was the capital.

Tourville, ANNE DE COFENTIN, COMTE DE (1642-1701), a great French admiral, was born near Coutances. Like Nelson, he was very delicate, but this did not prevent a highly successful naval career. Having served an apprenticeship under Duquesne in the Mediterranean, he became head of the newly-formed French navy in 1690. In the battle of Beachy Head in that year he gained the last great naval victory of France over England. Two years later he lost the battle of La Hogue, but was soon after made Marshal of France, and lived to inflict much damage on English commerce.

Toussaint l'Ouverture (1743-1803), the Negro chief, began his career by helping to drive the Spaniards out of Hayti. In reward for his

services the French Revolutionary Government raised him by gradual steps to the headship of the army in the island. He made use of his position to promote good government, but when Bonaparte attempted to re-establish slavery resisted. The result was that he was betrayed to the French, and died in the fortress of Joux in France.

Townshend, CHARLES, 2ND VISCOUNT (1676-1738), statesman and agriculturist, entered public life as a Tory, but soon became connected with the Whigs. In 1709, when the colleague of Marlborough at The Hague, he disagreed with him on the Barrier Treaty, for which the Tories nevertheless censured him. George I., even before his arrival in England, appointed Townshend his first Prime Minister, but soon dismissed him when he refused to sacrifice English to Hanoverian interests. He was then for a time Lord-Lieutenant of Ireland, but in 1719 rejoined the Ministry. He next became Secretary of State under his brother-in-law, Sir R. Walpole, and in 1725 concluded the Treaty of Hanover. Of this Walpole disapproved, and the result was the retirement of Townshend from public life. On his estates in Norfolk he introduced the cultivation of the turnip.

Townshend, CHARLES (1725-67), a grandson of the preceding, entered Parliament in 1747, and soon made for himself a brilliant reputation; but his faults balanced his talents, and his unstability gained him the name of "the weather-cock." Thus, when in 1761 he became War Secretary he supported Pitt and Bute alternately. He held office in the first Rockingham Administration, but on its break up became Chancellor of the Exchequer under Chatham. During the incapacity of the latter he was the leading minister, and used his position to resume the policy of taxing America, to which he was opposed. Had it not been for his sudden death Townshend would have become Premier instead of Grafton.

Toynbee, ARNOLD (1852-83), the philanthropist, was the son of a London surgeon. He was for two years at a military college, and then spent four at Balliol College, Oxford. He was much influenced by the social teaching of Ruskin. In 1875 he went to live in Whitechapel, and worked amongst the poor there. He was never strong, and the excitement attending the delivery of a public lecture, at which he encountered much interruption, is believed to have hastened his end. In his memory Toynbee Hall was established to carry on his work after his death, the study of political economy, practical and theoretical, being one of its chief objects, though all forms of literature and art are brought as close to the minds of the people as possible. Toynbee's *Industrial Revolution* embodies his most important economic lectures.

Trachea (WIND-PIPE). The trachea extends from the lower part of the larynx to about the level of the third dorsal vertebra, where it divides into the two bronchi. The framework of the trachea consists of a series of cartilaginous rings, from 16 to 20 in number, which do not extend completely round the tube, but are deficient behind,

where the cartilage is replaced by fibrous tissue. Within the rings is disposed the mucous tissue of the trachea. internal to which is the stratified columnar epithelium, which forms the inner lining of the tube; the most superficial cells, those which abut upon the lumen of the trachea, are ciliated. At the division of the trachea into the two bronchi, the latter are not quite symmetrically disposed with regard to the former, and when a foreign body obtains access to the trachea it is usually found that it penetrates into the right rather than into the left bronchus. The trachea is sometimes affected by inflammation, usually as the result of the extension of mischief from the larynx.

Tracheæ, a term applied strictly in vegetable histology to true vessels or cell-fusions in which the transverse walls have been absorbed. They occur in the wood of many spermaphytes. Elongated cells with lignified walls, losing their cell-contents (cytoplasm) at an early stage, and otherwise resembling tracheæ, are termed *tracheids*, the two being classed together as *tracheal tissue*. Tracheids are especially characteristic of the wood of Pteridophyta and Coniferæ. Tracheal tissue serves chiefly for the conduction of water.

Tracheal Gills are the structures found in many aquatic insects by which respiration is effected. They resemble and act as gills, though morphologically they are tracheæ. These are minute tubes usually ramifying throughout the whole body of the insect. In the aquatic forms these extend out from the body as plates or tufts, which come in contact with the air dissolved in the water.

Tracheata, a term used as the name of a group of animals, including all those which breathe by means of tracheæ—viz., minute tubes ramifying through the body and opening to the exterior. The group would include the Protracheata—i.e. *Peripatus* (q.v.)—the Myriapods (Centipedes and Millepedes), the Insects, and Arachnidæ. It is doubtful, however, whether the tracheæ in these four classes are developed in the same way, while many of the Arachnidæ, such as *Limulus* (the King Crab), breathe by gills, and not tracheæ. The name is not, therefore, generally adopted.

Tracheotomy, the operation of opening the trachea (with a view to the insertion of a tube through which the patient can breathe) in cases of obstruction to respiration through the natural passages, is sometimes performed in diphtheria and other forms of disease affecting the larynx, and in instances where pressure is exerted upon the upper air-passages by tumours and the like.

Trachymedusæ, an order of Hydrozoa belonging to the class Craspedota (q.v.), including those jelly-fish in which the tentacles are solid, except sometimes in the adult. The adult is produced by a series of metamorphoses from a small free larva, in the form of a small Hydralike animal. It includes two suborders, the Narcomedusæ and Trachomedusæ.

Trachynemites, one of the few known fossil jelly-fish. It belongs to the order Trachymedusæ,

the members of which have absolutely no hard parts in their bodies; they cannot, therefore, under ordinary circumstances, be preserved as fossils. Impressions of the body have, however, been left in the fine mud which has consolidated into the "Solenhofen slate" of Germany.

Trachyte, a volcanic rock or lava, named from the rough surface with which it breaks (Greek *trachus* = "rough"). It belongs in composition to the intermediate class, consisting essentially of sanidine felspar, and containing from 60 to 64 per cent. of silica. Its other chemical constituents are: alumina, 17 per cent., iron-oxide 6-8 per cent., soda 4 per cent., lime 3-5, potash 2-2.5, magnesia 1. In addition to sanidine it contains some triclinic felspar, and usually hornblende, biotite mica, and magnetite, with occasionally augite, apatite, and tridymite. Its average specific gravity is 2.65. It varies in texture, but is largely glassy with felspar microliths and hornblende needles. It belongs mostly to Tertiary volcanic outpourings, being one of the commonest of modern lavas.

Tractarians, the name given to a small band of men who started what was known as the "Oxford Movement" in 1833-41. They published a series of papers entitled *Tracts for the Times*. [NEWMAN.]

Traction Engine is a steam locomotive specially designed for drawing heavy loads over ordinary roads. The boiler is usually of the locomotive type, and a simple or compound engine is secured to the upper part of the shell. The crank-shaft (usually at the fire-box end) is connected by spur gear with a pair of large driving-wheels; the front wheels are capable of being turned for steering. To obtain sufficient grip on the road, and at the same time not to damage it, the driving wheels are made with wide rims, to which diagonal blocks are rivetted. Light traction engines are often used for agricultural purposes, in which case the gearing is made so that it can be detached from the wheels, in order that the engine may be used for driving threshing and other machines.

Trade, BOARD OF, is technically a Committee of the Privy Council appointed for certain purposes. Practically it is that department of the Government which deals with almost any point concerning national commerce. Originated by Cromwell, the institution had a chequered and spasmodic existence until 1786, when an Order in Council established it in much its present form. Since 1864 its President is a Cabinet Minister, and its principal officers are the secretaries and the chief of the Statistical Department. At different times the departments have been modified, and as new exigencies arise fresh modifications are made. Besides the original department of Statistics and Commerce, it has a Railway Department (1840), which examines plans for new railways, inspects railways before they can be opened, inquires into the causes of accidents, and controls also tramways, gas, water, and electric-lighting companies; a Marine Department (1850), which surveys

channels, etc., provides for examination of officers for Mercantile Marine, regulates shipping offices, pilotage, wage-disputes, etc.; a Harbour Department (1866), which deals with harbours, foreshores, lighthouses, navigable channels, etc., oyster- and mussel-fishing, piers, wrecks, quarantine, weights and measures; a Finance Department (1866); and the Fisheries Department. The Statistical Department issues monthly the *Board of Trade Journal*, which gives much valuable information as to consuls' reports, tariffs, markets, etc. The Labour Department, which has to collect information on such matters as the condition of employment, the details of labour disputes, etc., is the most recent addition. The Patent Office and the Bankruptcy Department are also under the Board.

Trade Marks. As early as the reign of Queen Elizabeth we have evidence of the existence of trade marks, and in 1783 Lord Mansfield decided a case concerning them. In 1875 an Act laid down a regulation as to what constitutes a trade-mark, and provided for their registration, an Act of 1862 having already made it a misdemeanour to counterfeit or forge a trade-mark. The Patents Act of 1883 now regulates the law of such marks, and under this Act registration gives exclusive right to the use of the mark after the lapse of five years, and this registration protects such use for fourteen years. Should the Comptroller of Patents refuse to register, there is an appeal to the Board of Trade, and so on to the House of Lords. An international convention of 1883 was held upon the subject. An Act of 1887 consolidates the regulations and defines offences. There are five provisions as to what constitutes a trade-mark; it may be (1) the name of a person or firm printed, impressed, or woven in a particular manner; (2) a written signature, or copy thereof; (3) a brand, device, heading, label, mark, or ticket; (4) an invented word or words; (5) any word or words not bearing any geographical import. The latest important enactment on this question is that which enforces the marking of the country of origin upon all foreign manufactured goods imported into the United Kingdom.

Trade Unions may be described as the association of workmen in particular branches of trade for joint action in certain directions, namely, the regulation of wages, hours, and other conditions of labour, and for mutual relief. Trade unions (which have not yet been connected historically with the mediæval guilds which they resemble in some respects) arose in various trades in England during the last century, as the mediæval regulation of trade broke up and the distinction of master and workman became sharper. In 1799 all combination among workmen was prohibited by law; in 1824 the law was repealed, and a period followed of great activity, which excited much hostility among the middle classes, evinced, *e.g.* in the sentence of seven years' transportation on six Dorchester labourers in 1834 for conspiracy (in administering a trade-union oath). This activity declined with Owenism [OWEN] and Chartism (*q.v.*), but the great strike of engineers in 1852 and builders in 1859 gave the movement a fresh impulse.

The Royal Commission of 1867-69 was appointed in consequence of the outrages which were committed under the auspices of certain unions in Sheffield and Manchester, "rattening" being one of the most innocent of the malpractices. These outrages have been graphically, and apparently not unfairly, described by Charles Reade in *Put Yourself in his Place*. The outcome of the Commission was the passing of the Trades Union Act of 1871 and 1876, which together recognise trade unions, secure protection to their funds, and legalise "picketing" unaccompanied by violence.

Since that time the principle of trade unionism has steadily developed, and some of the developments give much food for reflection. The main objects of the majority of trade unions may be put down under some or all of the following heads: (1) The publishing of statistics as to the condition of trade; (2) the registration of men and masters in search of and prepared to give work respectively; (3) the aid of members of the association who are in search of work; (4) the regulation of the number of apprentices to be employed; (5) the aid of members of other trades who may be on strike; (6) the regulation of conditions of work; (7) the organisation of strikes in the event of the failure of more pacific methods of attaining their ends. Almost invariably trade unionists refuse to work with those who are not members of the union, a practice which seems inconsistent with that freedom of action in disposing of his labour which is thought to be every freeman's right. On the other hand, it should be pointed out that most unions insist upon their members doing their work in a proper manner, the result of complaints in this direction being reprimand, and, if necessary, expulsion from the union. Strikes, as Prof. Marshall has pointed out, are, like warfare, an admission that peaceful means have proved inadequate; and in spite of the combative attitude of the "New Unionism," many authorities prophesy that labour warfare will in time lead to industrial peace through Boards of Conciliation.

The general working of a union may be judged from some details concerning one of the most widespread and important of these societies—that of the Amalgamated Engineers. This contains 424 branches. The central authority is vested in a General Council, whose permanent officer is the General Secretary, who receives a good salary, has large powers, and has among other duties that of issuing weekly, monthly, and yearly reports. Next come local district committees; and each branch manages its affairs through a secretary and a referee, elected annually, and a president, vice-president, and assistant-secretary, elected quarterly, assisted by a committee and various subordinate officers. Attention to duties is secured by a system of fines upon those who are negligent. The Society of Compositors has a peculiar feature in the existence of "Fathers of Chapels," whose duties are to see that society regulations are carried out in the places where they are employed. This may be a relic of the old printing guilds.

Trade Winds. [WINDS.]

Traditor, among the Early Christians, one who in time of persecution gave up the names of his brethren, or any of the holy vessels, to the officers of the law.

Trafalgar, CAPE, a promontory near the southern extremity of the Spanish peninsula, 29 miles W.N.W. of Tarifa. It is famous as the scene of Nelson's last battle (October 21, 1805), in which a brilliant victory was gained over the French and Spanish fleets.

Tragedy. [DRAMA, THEATRE.]

Tragopan, any bird of the genus *Cerionis*, of the Pheasant family, with five species from the Oriental region. The plumage is brilliant, there is a wattle, inflatable at will, on the throat, and from the erectile horns these birds are sometimes called Horned Pheasants.

Trajan (MARCUS ULPIUS TRAJANUS), Emperor of Rome, was born in Southern Spain in the middle of the 1st century. Having served with distinction in the Roman armies, he was in 97 adopted by Nerva as his successor. Next year he succeeded to the purple. After several campaigns he brought the Dacians under the rule of the Empire. In 113 he set out on an expedition to the East, and soon reduced Armenia and Mesopotamia; but in 117 died in Cilicia, when on his way back to Italy. As memorials of his greatness he left the Forum Trajani and Trajan's Column at Rome, the harbour of Civita Vecchia, and Trajan's Wall, running from the Danube to the Black Sea. He was one of the best of the Cæsars.

Tramways (Norse *tram* = "log") is generally used to signify a street railway, along which cars are smoothly propelled by horses, steam, electricity, or other motive power. Such roads were early employed in mining districts for the purpose of hauling coal and other minerals more easily. Mr. Outram in 1800 tried to develop the system, and some have looked to his name for the etymology of the word. A tramway was constructed in 1801 between Croydon and Wandsworth; but Mr. George Train started the first street tramway at Birkenhead in 1860, and in 1861 he was allowed to give the experiment a trial in Park Lane, London. The idea, in spite of discouragement, caught on, and in 1870 such progress had been made that the Tramway Act was passed, having for its object to provide for questions of right of passage, gauge, width, repairs, powers of purchase, etc., and tramways are now, like railways, subject to Board of Trade inspection. The earlier tramways sometimes had rails above the level of the roadway, but this system entailed such difficulty and danger to ordinary traffic that it was generally abandoned, and the system, now generally in use, was adopted in which the rail has a groove, into which a flange upon the wheel fits. The advantage of this is that derailment is almost obviated, but it has the disadvantage of increasing friction, owing to the choking up of the groove. Many years ago the omnibuses plying in the suburbs of Manchester passed through Salford upon plain rails, flush with the street, the vehicle being kept on the line by

means of a wheel, which could be let down, and which fitted into a groove running parallel to and midway between the rails. The system of flat rails prevails in some Continental towns. The friction is less, especially upon curves, but derailment is frequent. The tramway companies are, for obvious reasons, compelled to keep their ways in repair, as well as the roadway to a certain distance on either side of the line, since the constant drawing on and off the line of ordinary vehicles greatly tries the outer edge of the rail and the roadway adjoining it. Horse-draught is the most common mode of propulsion, but the constant straining upon starting tells heavily upon horses, and other and more economical methods have been adopted. Of these steam is the most objectionable, and has been little used. Compressed air has been tried, with moderate success. Upon steep gradients an endless travelling cable worked by a fixed engine has been found very efficacious. In this system the passenger car is preceded by a dummy car, which has an ingenious arrangement for gripping and letting go of the rope. The system may be seen at Highgate Hill, and at Streatham Hill and Brixton, and at Melbourne, Australia. Probably the coming motive-power for trams is electricity. When horses are not employed a more elaborate system of points is required at crossings, since no side inclination can be given to the car. In the matter of cars there is much to be learnt from some of the Continental arrangements.

Transcendentalism represents the doctrine of some of the Schoolmen that there are ideas which rise entirely above (transcend) experience, and cannot be brought under any of the Ten Categories. Such an idea is that of *Ens* (τὸ ὄν), *pure being*, which embraces the One, the Pure, the Good. Kant draws a distinction between Transcendent and Transcendental. By Transcendental he understands such *à priori* ideas as are manifested only in experience, *e.g.* Time, Cause, Space, etc. (*i.e.* what has relation to the permanent mental conditions of experience); while by Transcendent he understands "such ideas as are above experience, *e.g.* God, Soul, etc." The term Transcendentalism has now come to be synonymous with high-flown, fanciful, impracticable ideas, which refuse to be controlled by experience. It has also been applied to the idealism of Emerson (q.v.).

Transept, one of the two subdivisions of the transverse arm of a cruciform church.

Transformer, in electricity, is a device by means of which the pressure of an alternating current may be increased or reduced, the current strength being correspondingly reduced or increased. It essentially consists of two coils of insulated wire, wound on an iron core, usually so arranged that the magnetic circuit is closed. Numerous inventors have designed many different patterns, which, however, principally differ in appearance and in the ease with which they may be constructed. The iron core must be carefully laminated to avoid loss by eddy currents, and as transformers are usually used to reduce a current

at 2,000 volts in the mains to a current at 100 volts suitable for use in houses, great care must be expended upon the insulation of one coil from the other. If a current at 2,000 volts is to be converted to one at 100, the primary winding must have twenty times as many convolutions as the secondary, and as the secondary current will be twenty times stronger than the primary, the former main must be of twenty times the section of the latter. A current at 2,000 volts can of course be distributed by a much smaller main conductor than one at 100 volts, and thus a saving both of capital and expenditure by loss in mains may be effected, more especially in supplying a scattered district; but against this must be set the cost of transformers and loss by reason of their want of perfect efficiency.

Transfusion. The operation of transfusing either the blood of a healthy person or some form of saline infusion into the veins of another person is in rare instances performed. It is of value in cases where the patient operated upon has been the subject of great loss of blood, or where the blood, though normal in quantity, is poisoned by carbonic oxide or by certain disease products.

Transit Circle, or MERIDIAN CIRCLE, is an improved form of transit instrument. The latter was invented by Römer at the end of the 17th century for noting the time of a star's passage over the meridian. The time noted on a sidereal clock, and converted into degrees at the rate of 15° per hour, gives the right ascension of the star. A meridian quadrant had been used by Tycho Brahe, but neglected until Römer revived the idea that a fixed meridian instrument would enable observations to be made with far greater convenience than the method generally employed. It consists of a horizontal axis, with a telescope fixed at right angles to it, the whole being adjusted so that the telescope shall revolve in the plane of the meridian. The axis of the instrument consists of a cube of metal, at opposite sides of which are two cones ending in cylindrical pivots, resting in V-shaped bearings. The telescope is fixed in a hole through the centre of the cube, and a certain arrangement of levers and friction wheels is adjusted to relieve the pivots of most of the weight of the instrument. So far this is a transit *instrument*, and the transit *circle* differs from it in possessing two large circles—a yard or more in diameter—fixed on the axis at each side of the telescope, the circumference of each being graduated to $5'$ or less. The readings are made by four or more microscopes (which thus correct each other), often fixed to the stone piers which support the whole. The instrument is adjusted so that its axis is horizontal and points due east and west, while the axis of the telescope is at right angles to it. Although workmanship of the very highest order is expended, absolute accuracy in these adjustments is never obtained, but the errors due to the different deviations can be separately estimated, and the observed result can be corrected for them. It is essential that the telescope shall be quite rigid, for any bending will give rise to errors in the calculated declination of the observed star. The telescope is provided with

several vertical and one or two horizontal spider-lines, and the time of passing each vertical line is noted by a clock. This is usually provided with a seconds pendulum which, by passing through a globule of mercury, completes an electric circuit once every swing. A time-recorder or similar contrivance is then brought into play, and a dot is marked on a moving slip of paper every second; but the observer, as he sees the star cross a certain line, can, by pressing a knob, also cause a dot to be made on the slip of paper. The distance of this dot from the previous second's dot enables him to tell to less than one-fifth of a second the exact time of passage of the star. By means of the transit circle not only is the time of transit of a star measured but also its declination—a feat impossible with the older transit instrument. The first transit *circle* used in Great Britain was set up at Greenwich in 1850, the transit instrument and mural circle having been used till then, although long superseded at Göttingen and Königsberg by the circle.

Transit Instrument. [TRANSIT CIRCLE.]

Transit of a Star occurs when the star just crosses the meridian, and is the phenomenon observed for determining the right ascension of the star. [TRANSIT INSTRUMENT.] The absolute right ascension of a star is obtained by noting the time which elapses between its transit and that of the sun, the declination of the latter being observed at the same time. Transit is also the name given to the passage of one celestial body across another. Thus Jupiter's satellites exhibit transits across his disc in front as well as suffer eclipses behind him. The more important transits, however, are those of the inferior planets Venus and Mercury across the sun's disc. The transit of Venus especially has caused more excitement than any other astronomical phenomenon, and more pains have been taken to observe it accurately. Correct observations on this motion owe their importance to the fact that they have been used as the chief factors in the determination of the sun's distance from us, and therefore in the estimation of all astronomical measurements. [VENUS.]

Transmigration, the doctrine of the re-birth of the human soul in another human body, or in that of one of the lower animals. In a very primitive form the belief in transmigration exists among many of the lower races at the present day; but it was in the East that the doctrine first appeared as having a bearing on man's conduct, the good rising higher and the bad falling lower at each re-birth. From India it passed to Egypt, whence the Greeks borrowed it and brought it to Europe; the Romans received it from the Greeks. Whence the Jews learnt it is uncertain, but traces of it may perhaps be detected in Wisdom viii. 20 and John ix. 2. The question in the last-cited passage may be an echo of the Hindu teaching that the wicked shall be born again blind or deformed. In the present day the theory has attractions for many, since it seems to be the complement of, or, more properly, implicitly contained in, the theory of evolution. This notion is found in Kingsley's *Water*

Babies (ch. ii.) as a kind of gloss on "It doth not yet appear what we shall be" (1 John iii. 3). Tylor (*Primitive Culture*, ii. 2) puts the case strongly: "One of the most notable points about the theory of transmigration is its close bearing upon a thought which lies very deep in the history of philosophy—the development theory of organic life in successive stages. An elevation from the vegetable to the lower animal life, and thence onward through the higher animals to man, to say nothing of superhuman beings, does not here require even a succession of individuals, but is brought by the theory of metempsychosis within the compass of the successive vegetable and animal lives of a single being."

Transmission of Power. It is generally necessary to convey the power developed by a steam-engine or other prime mover, to a greater or less distance before it can be made available. Thus in factories rotating shafts and belt- or rope-gearing (q.v.) are employed to distribute to various machines the power of a main engine. In many cases power can be cheaply generated at some place where it is not wanted; and it is, therefore, of great importance to have some efficient method of transmitting it to places, possibly at a considerable distance, where it can be made use of. Rope-gearing, on an extended scale, may be used, but a long length of wire rope must be supported at frequent intervals upon pulleys, and the consequent friction produces a serious loss. The system is, however, rather extensively used for the propulsion of tram-cars, as the excess of the cost of power produced by horses over that of a steam engine is sufficient to allow of a large loss in transmission. A continuous loop of steel wire cable travels in a slotted tube, buried in the roadway, being, of course, supported on suitable pulleys, and is kept in motion by passing round a drum in the engine-house, this drum being turned by an engine. A clutch on each car projects into the tube, and can be caused to grip the moving cable as required. Fluid pressure—of steam, air, or water—is used for power transmission in various ways. Steam from a boiler may be conveyed for a limited distance in pipes if precautions are taken to avoid loss of heat by radiation, and may, of course, supply an engine of any kind, but the loss due to condensation is so serious that the distance can only be comparatively small. Compressed air is frequently used to supply power at the bottoms of mines, an engine on the surface pumping the air into a pipe leading to an air-engine below. The heat produced during the compression of the air [THERMODYNAMICS] is, however, a source of loss. Hydraulic power is of much more general application, for water at a pressure of 700 or more pounds per square inch may be conveyed for long distances in pipes with but little loss by friction, and can be conveniently applied to the operation of lifts, cranes, riveting and other machines. Power is in this way distributed over a considerable portion of London and other large towns, as well as in docks, on board ships, etc. For most purposes electricity seems the most

efficient agent for the transmission of power. [DYNAMO MACHINE.] The substitution of small electric motors for the shafting and belts in many factories would result in an economy, and it is proved by experience in America and other places that, when the conditions are suitable, power can be supplied to tram-cars by electricity more efficiently than by any other means. The fact that a high-tension current can traverse a long wire with a trifling loss has already rendered it possible to transmit power efficiently to a distance of more than 100 miles, and the work of distributing some of the power of Niagara Falls is now in progress, with every prospect of being, scientifically at any rate, a success.

Transom, in architecture, the crossbar separating a door from the fanlight above; also a bar of timber or stone across a window.

Transpiration, the loss of water in the form of vapour from the general surface of a plant, especially through the stomata. Stephen Hales determined that a sunflower with 5,616 square inches of leaf-surface loses 30 fluid ounces in 12 hours' daylight. Transpiration is most active in dry, warm air, and in the light, as then the actively-assimilating guard-cells of the stomata become most turgid and curved. Transpiration sets up a current from the roots, which has been measured, by adding a solution of lithium-citrate, and then using the spectroscope, as 118 centimetres an hour in the tobacco-plant. This current travels by way of the xylem of the alburnum, the tracheal system of which contains broken columns (*'chapelets de Jamin'*) of air and water. The air is rarefied by the removal of its oxygen, becoming, in the tops of trees, almost pure nitrogen; and the active protoplasmic cells of the medullary rays, in their rapidly-alternating katabolic and anabolic processes, liberating and absorbing water, act on the tracheal elements alternately as force-pumps and suction-pumps. As these tracheal elements have their transverse septa at one level in each radial series, but not at the same level in the contiguous series, the water travels upwards round the stem, step by step, the pits in the radial walls of the vessels being its chief channel. This complex process has been successfully investigated by Sachs, Elfving, Robert Hartig, and, above all, Emil Godlewski.

Transport, a vessel employed by government for carrying soldiers, warlike stores, or provisions.

Transportation is the banishing of a criminal into another country. This punishment was introduced in the reign of Queen Elizabeth, and is now chiefly regulated by the Statute 5 Geo. IV., c. 84. [PRISONS.]

Transubstantiation is a doctrine of the Greek and Roman Churches, which teaches that in the Eucharist the substance of the bread and wine is changed into the body and the blood of Christ, although the accidents of the bread and wine remain. The belief is to be found as early as the ninth century, though the *term* was not formally approved till the Fourth Lateran Council, in 1215.

The Council of Trent stated the doctrine explicitly as against those who held the doctrines of *impanation* and *consubstantiation*. The Catholic Church holds that the Greek and Latin Fathers imply the doctrine, though they may not explicitly declare it. The truth of the doctrine is utterly beyond proof upon physical principles, especially to those who, rejecting the old scholastic theory of substance and accidents, look for nothing beyond phenomena, and Catholics of this type can only look upon it as the working of a perpetual miracle utterly beyond the comprehension of reason.

Transvaal, THE. or, SOUTH AFRICAN REPUBLIC, an independent state of South Africa, situated between lat. 22° 15' and 28° S., and long. 25° and 32° 10' E. It occupies an elevated plateau, with an average altitude of 3,000 feet, the configuration of which has been compared to a saucer. The adjoining regions are—British Bechuanaland on the W.; the British possessions administered by the South Africa Company on the N.; Portuguese East Africa, Swaziland, and Zululand on the E.; Natal on the S.E.; and the Orange Free state on the S. The plateau is drained by two great rivers—the Vaal, which skirts the state on the S., and the Limpopo, or Crocodile, which, flowing N.W. from Pretoria, sweeps round so as to form the boundary on the N.W. and N., after which it trends away in a S.E. direction. Owing to its elevated position the climate is, on the whole, more salubrious and bracing than is usually the case in the neighbourhood of the tropics. More attention is given to stock-breeding than to tillage, but fine crops of wheat and oats are raised on the Hooge Veld and elsewhere, and coffee, sugar, and rice grow luxuriantly in the northern regions. The Transvaal is a famous hunting-ground, but the big game, including the leopard, lion, buffalo, elephant, and giraffe, which attracted the earliest European visitors, have, to a great extent, been driven further inland. The mineral wealth of the country is very great, and the prospects of the gold industry, which has advanced rapidly during recent years, are said to be satisfactory. The original founders of the state were Boers, who migrated from Cape Colony between 1833 and 1837 in consequence of the policy of the British Government. The independence of the new settlement was practically acknowledged by the British authorities in 1852. Owing to the financial embarrassment and general disorder, produced mainly by constant wars with the natives, the country was annexed by the English in 1877. The Boers, however, were dissatisfied with British rule, and in 1880 a revolt broke out, which was terminated in the following year by a treaty restoring self-government in internal affairs, but leaving the control of foreign relations to the British Crown. Further concessions were made in 1884, when the British Resident was replaced by a Diplomatic Agent. There are two legislative bodies, called Volksraden, each containing 24 members. The executive power is in the hands of a President, assisted by a Council of 8 members. The greater part of the

inhabitants belong to the United Dutch Reformed Church. Pretoria is the principal town.

Transylvania, the easternmost portion of the Austrian Empire, bounded by Hungary on the N. and W., Bukowina and Moldavia on the E., and Wallachia on the S.; area, 21,512 square miles. It consists of a tableland, enclosed on the N., E., and S. by the Carpathians, and crossed by spurs of the same mountains. The Latin name, which has been in use since the twelfth or thirteenth century, refers to its position "beyond the woods" of Hungary. Although wide tracts are still covered with the forests, from which its Magyar and Roumanian names (Erdély and Ardealn) are derived, nearly one-half of the surface is either tilled or pasture-land. The soil is fertile, yielding abundant crops of maize, wheat, rye, flax, hemp, and tobacco; the vintage is also plentiful, and various fruits, such as the apple, peach, plum, and almond, are extensively cultivated. Horse-breeding is an important industry. The forests maintain large herds of swine, and much care is devoted to the rearing of cattle and sheep. Transylvania is rich in gold and silver; copper, quicksilver, iron, lead and salt are also worked. The manufactures and commerce are inconsiderable. More than half the population is composed of Roumanians or Wallachians, who, prior to 1848 had no share in the political privileges enjoyed by the Hungarians, the Szeklers, and the Saxons (Germans who colonised the country in the twelfth century); there are also large numbers of gypsies, Jews, Greeks, Armenians, and Slavs. After the struggle in 1848 between the Roumanians on the one hand and the "privileged nations" on the other, Transylvania was made an Austrian Crown-land; but, in 1860 a return was made to the older arrangement, and in 1868 it was finally incorporated in Hungary. Recently the Roumanians have complained, with some reason, of Magyar oppression. Klausenburg, Hermannstadt, and Kronstadt are the principal towns.

Trappists, THE, an order of Cistercian monks, originally founded in 1140 at La Trappe in the French department of Orne. The rules were very rigid; but, as with other orders, they were neglected, and reform was badly needed at the time of its introduction by Abbot de Rancé, in the middle of the 17th century. The time of the monks is divided between work, meditation, and prayer. They rise to the first service at 2 a.m., and go to bed at 8 p.m., and pass twelve hours out of the twenty-four in prayer. They are vegetarians, but are allowed milk and cheese, except on fast-days. Some houses permit beer, cider, or wine as a drink. Perpetual silence is the rule, except on specified occasions, the Abbot and the Guest-Master only being allowed to speak. The order is to be found in England, Ireland, France, America, and Belgium. There is a house near Leicester, and the house in the Belgian Campine, near Antwerp, has turned the sandy waste around into flourishing farms and plantations. "Memento mori" is the watchword, a skeleton points out the hour upon the clock, and a grave is always kept open for the next to die.

Travancore, a native state of India, under British protection, at the southern extremity of the peninsula, between the Western Gháts and the Arabian Sea. It is connected with the Madras Presidency, and has an area of 6,730 square miles. The state is traversed by spurs of the Western Gháts, beyond which a plain, 10 miles in width, densely covered with areca palms and cocoa-nuts, stretches along the coast. In the valleys are many lagoons, formed from the overflow of the rivers. The products include rice, pepper, cocoa-nut, areca-nut, copra, and tobacco. Trivandrum is the capital.

Travertine, a freshwater limestone, deposited by springs, is said to take its name from Tiburtino or Tivoli (the ancient Tibur), where it accumulates very rapidly. At San Filippo, in Tuscany, it forms a foot thick in four months, a hill $1\frac{1}{4}$ mile long, $\frac{1}{3}$ mile broad, and over 250 feet high, being made up of it. It varies in texture, but is generally rather porous, and white or light-coloured. It is, however, largely used as a building-material in the Coliseum and elsewhere in Rome, in the Roman Pharos in Dover Castle, and in many Kentish churches. Its formation is probably initiated by the action of living green mosses, *Hyppnum*, etc., removing carbon-dioxide from the water, and thus bringing about the precipitation of calcium carbonate. The springs are, therefore, termed "petrifying" ones. The rock is also known as *calcareous tufa* or *sinter*.

Treadmill, as an instrument of punishment in use in prisons, was introduced into our system by Sir William Cubitt in 1818. It consists of a wooden cylinder, fixed upon an iron framework, from 20 to 25 feet wide, and 5 to 6 feet in diameter, and is fitted with steps $7\frac{1}{2}$ inches apart. Its speed is regulated by a brake, and the circumference generally passes over a distance of 32 feet per minute. The time spent on it is generally 6 hours per day, divided into two spells of 3 hours each, the alternation of work and rest during this time being 15 minutes of the former and 5 minutes of the latter. A man thus climbs more than $1\frac{1}{2}$ miles per day. The men upon it are in separate compartments, and have a hand-rail to hold on by. The wheel is generally made to do some useful work, such as grinding corn or pumping water.

Treason is the highest crime known to the law, and it consists—

1. In compassing the death of the Sovereign, or his or her Consort, or of the Prince of Wales.
2. Violating the Consort of the King, or his eldest daughter unmarried, or the Princess of Wales.
3. Levying war against the Sovereign within the realm, or being adherent to such, or relieving same.
4. Killing the Lord Chancellor or the Lord Treasurer, or any judge while on the Bench; and generally
5. Committing such other offence or offences as should by any Act of Parliament be declared treason.

A person accused of treason must be prosecuted within 3 years of its commission, if the offence be committed within the realm, except in case of a designed assassination of the Sovereign. When the treason consists of an attempt to assassinate the Sovereign the offence is triable as *murder*, but continues punishable as treason. Under the Statute 11 and 12 Vict., c. 12. it is made *felony* to intend to

depose the Sovereign, or to place duress upon her in order to compel her to change her counsels, or to intimidate either House of Parliament, or to incite any foreigner to invade the Kingdom. Lastly, under the Statute 5 and 6 Vict., c. 51, it is made a high misdemeanour to strike at the Sovereign, or to discharge firearms near her person with intent to alarm her, and it is immaterial whether the pistol or gun be loaded with ball or not.

Treasure Trove. Any money, coin, gold, silver, plate, or bullion *found* (*trouvé*) hidden in the earth, the owner thereof being unknown, in general belongs to the Crown, and forms one of the precarious sources of its revenue. When, however, it is found in the sea, or upon the earth, it does not belong to the Crown, but to the finder, in case no one appears to claim it. In many cases treasure trove belongs by special grant or prescription to the Lord of the Manor within whose limits it is found.

Treasury, THE, a Governmental department which has charge of the Civil List and the receipts and expenditure of the revenues generally. It was originally presided over by the Lord High Treasurer, but this office has been continuously, from the reign of Queen Anne, put in commission. The Commission consists of the First Lord of the Treasury, who is generally Prime Minister, the Chancellor of the Exchequer, who is head of his own department, and three junior Lords. There are also two secretaries—the Patronage Secretary, better known as the Government Whip, and the Permanent Secretary. The three junior Lords are generally English, Scottish, and Irish respectively. The working of the department is entrusted to the Chancellor of the Exchequer, the Patronage Secretary being responsible for correspondence, and the Financial Secretary preparing the Civil Service Estimates. But the real working of the details depends upon the permanent officials, especially the Comptroller General. The Treasury exercises general control where no special provision is made, and has special supervision of the Inland Revenue, the Customs, Woods and Forests, and Post Office Departments. It has its own solicitor, who also discharges other duties; and the Paymaster-General is concerned in distributing pay to the army, navy, etc. The *Treasury Bench* in the House of Commons is the front bench on the right hand of the Speaker.

Treaty signifies the discussion of terms which immediately precedes the conclusion of a contract or other transaction. A warranty on the sale of goods, to be valid, must be made during the treaty preceding the sale. In public and international law a treaty is an agreement between the Governments of two or more states. Such an agreement is obviously not enforceable by legal proceedings. In England the power of making treaties with foreign states is vested in the Crown as part of the prerogative of the Sovereign. In some cases, however, treaties made by the Crown are not valid in the Courts of this country unless concluded under the powers of an Act of Parliament—for instance, *extradition* (q.v.).

Trebizond (Turkish *Tarabzûn*), the capital of a pashalic of Turkey in Asia, situated on the Black Sea, near its S.E. extremity. Its importance is due to its position on the great trade-route from Europe to Persia and Central Asia. The town stands on a sloping plateau, and is surrounded by ancient Byzantine walls with picturesque towers. The ancient Greek city of Trapezus was founded by colonists from Sinope about 700 B.C.

Tree-Frog, any individual of the amphibian family Hylidæ, widely distributed, and modified for arboreal life. On the last joint of each toe is a sucker, and these enable the frogs to cling to the smooth surfaces of leaves. The common Tree-Frog (*H. arborea*) is found in Europe, though not in Britain. It is bright-green in colour, and smaller than the common Frog.

Tree-Worship probably arose from the conception that trees were the residences or embodiments of spirits or deities. Sir John Lubbock believes that it was general to most of the great races of mankind at a certain stage of mental development. Fergusson's *Tree and Serpent Worship*, and Tylor's *Primitive Culture* are the best authorities on the subject.

Trefoil, a general name for the species of the leguminous genus *Trifolium*, and some allied plants with ternate leaves, especially those which are commonly grown as fodder for cattle. *Trifolium procumbens* is known as "hop trefoil," from the shape of its flower-heads, and our species of *Lotus* as "bird's-foot trefoil," from the three horizontally-spreading claw-like legumes in an umbel. *Trifolium incarnatum*, from being of comparatively recent introduction, is generally known to farmers simply as "trifolium." [CLOVER.]

Trelawney, EDWARD JOHN (1792-1881), the friend of Shelley and Byron, entered the navy at an early age, and afterwards deserted. He met Shelley at Pisa just before he was drowned, and, when the poet's body was recovered, superintended its cremation. He was afterwards with Byron in Greece, and subsequently travelled in America. He died in England, but his ashes were laid beside the graves of Shelley and Keats at Rome. He wrote *Recollections of the Last Days of Shelley and Byron* (1858), which was republished twenty years later.

Trelawney, SIR JOHN, one of the Seven Bishops, held successively the sees of Bristol, Exeter, and Winchester, but is still better remembered as the hero of the Cornish ballad, *And shall Trelawney Die?* He did die—peacefully—in 1721.

Trematoda, a class of worms, including the "Flukes" (q.v.). They are characterised by the fact that the body consists of a single segment, of a flattened leaf-like-form, provided with suckers, and generally, also, hooks. The mouth leads into a branched alimentary canal, but there is no anus. The nervous system is on the dorsal side of the animal. The animals are hermaphrodite, with one exception. The classification of the order is as follows:—

I. MONOGENETIC—development direct.

1. *Tristomeæ*.—Usually three suckers, e.g. *Tristomum*.
2. *Polystomeæ*.—Numerous suckers, e.g. *Polystomum*, *Aspidogaster*.

II. DIGENETIC—animals pass through a metamorphosis.

1. *Monostomidæ*.—One sucker.
2. *Distomidæ*.—Leaf-like bodies, e.g. *Distomum* (Liver Fluke), *Bilharzia* (the cause of the disease known as hæmaturia).
3. *Gasterostomidæ*.—Of which the larvæ (*Bucephalus*) live in oysters, &c.
Holostomidæ, e.g. *Holostomum*, which is parasitic in birds.

Trench, RICHARD CHEVENIX (1807-86), was born at Dublin and educated at Harrow and Cambridge. He took orders, and, after being curate to Samuel Wilberforce, became, in 1847, professor of theology at King's College, London. In 1856 he was made Dean of Westminster, and in 1864 Archbishop of Dublin. Besides some poems, he was author of *Notes on the Miracles*, *Notes on the Parables*, *English—Past and Present*, *The Study of Words*, and other less popular works.

Trenck, BARON FRANZ (1711-49), was the son of an Austrian general. He was obliged to leave the Imperial service on account of misconduct; but, after having been dismissed from the Russian, for similar reasons, was allowed to raise and command a regiment of Pandours for Maria Theresa, in the Austrian Succession War. In 1745 he made an unsuccessful attempt to capture the person of Frederick the Great, after which he was tried by court-martial and condemned to imprisonment. After one escape, he was incarcerated at Brünn, and there took poison. His cousin FRIEDRICH (1726-94) had a somewhat similar career. While in the Prussian army he intrigued with the Princess Amelia, and was imprisoned for corresponding with his Austrian cousin. After a short period of service in the Austrian army, he was recaptured and imprisoned at Magdeburg, where he was heavily ironed. After nearly twenty years' captivity he was released, and became a wine merchant at Aix-la-Chapelle. He was guillotined at Paris during the Revolution. Both cousins left autobiographies, but that of the Prussian Baron is the most famous.

Trent, a river of England, which rises on the borders of Staffordshire and Cheshire, flows S.E. through the former county, then N.E. through Derbyshire, Leicestershire, Notts, and Lincolnshire, and, by its junction with the Ouse, 15 miles W. of Hull, forms the River Humber. It has a course of about 150 miles, 25 of which are navigable for vessels of 200 tons. A far-spreading system of canals connects it with the principal Midland towns.

Trent (German *Trient*, Italian *Trento*), an Austrian town, on the Adige, in the S. of the Tyrol, 60 miles N. of Verona. Its embattled walls and towers, stretching right across the valley, give it a very picturesque appearance, especially when seen from the N. Its aspect is thoroughly Italian, and Italian is the only language spoken. The cathedral, which ranges in style from the 13th to the 15th century, is supposed to retain some Lombardic work as old as the 7th or 8th century.

The 15th-century church of Sta. Maria Maggiore was the meeting-place of the celebrated Council (1545-63). There is a large trade in wine, grain, fruit, and marble.

Trent, THE COUNCIL OF, commonly regarded as the eighteenth Ecumenical Council of the Church, met at Trent on December 13, 1545, and, after frequent adjournments and reopenings, was dissolved on December 4, 1563. A General Council had long been advocated by the more earnest and liberal-minded among the princes, prelates, and scholars who clung to the old religion, as the most efficacious method of removing real abuses and averting the progress of heresy and schism. Luther, and the Protestant princes who favoured him, had also expressed a desire for such a meeting, though with a far different object in view. The proposal was supported, for his own ends, by the Emperor Charles V.; but, owing to the delays created by the Popes, who feared a diminution of their power, the Council was not opened till the last month of 1545, in the twelfth year of the pontificate of Paul III. It was presided over by three Legates, the Cardinals Del Monte, Cervino della Croce, and Reginald Pole, by whom the committees appointed to prepare subjects for discussion were in all cases chosen and instructed, so that it was soon obvious that the proceedings would be conducted in complete harmony with the Pope's interests. It was generally hoped throughout Europe that the reformation of the Church "in its head and members" would at once engage the attention of the Council, but the first three sessions were wasted in preliminaries, and when the actual business of the Council began matters of practical importance were subordinated to questions of doctrine. From the outset the decisions on these points ran entirely counter to Protestant views. Thus in the fourth session ancient tradition was declared to be no less binding than the express commands of Scripture, the canonical character of the Apocrypha was maintained, and the Vulgate was received as authentic. The judgments given regarding original sin, justification, and the number, nature, and administration of the sacraments in the fifth, sixth, and seventh sessions, were equally uncompromising. An attempt of the Pope to transfer the assembly to Bologna resulted in its adjournment for an indefinite period (September, 1547), and with the exception of a twelve months' session in 1551, in which the Real Presence, transubstantiation, and the necessity of penance and extreme unction were affirmed, its debates were not reopened till 1562, in the third year of the pontificate of Paul IV. During the closing sessions some enactments were passed improving ecclesiastical discipline, but the Italian bishops successfully resisted all attempts to introduce sweeping reforms. The decrees regarding Purgatory, the worship of saints, relics, and images, indulgences, and similar matters could not fail completely to alienate all who had any sympathy with the Protestant party. On the whole, it may be said that by its policy at the Council of Trent the Roman Church took up a position which has rendered reunion for ever impossible.

Trenton, the capital of New Jersey, U.S.A., situated on the left bank of the Delaware, 33 miles north-east of Philadelphia. Recent improvements have rendered it a handsome and well-built town. The chief manufactures are earthenware, stoneware, iron, and steel.

Trephine. An instrument used for the purpose of removing a small portion of the skull with a view to relieving pressure, or dealing with collections of matter, or localised disease affecting the brain.

Tretenterata, a subclass of Brachiopoda or Lamp Shells, comprising those forms in which the valves of the shell are not hinged but held together by muscles, and in which there is an anus. The subclass comprises five families, of which two are extinct, while living representatives of the others are very rare. The best known genus is *Lingula*, the type of the family *Lingulidae*, which ranges from the Cambrian to the present with extremely slight variations. *Crania*, which lives attached to rocks, mollusca, etc., and ranges from the Ordovician (Lower Silurian); the shell in this is small, and the free valve is somewhat pyramidal; it is the type of the *Craniidae*. The other three families are the *Obolidae*, *Trimerellidae*, and *Discinidae*.

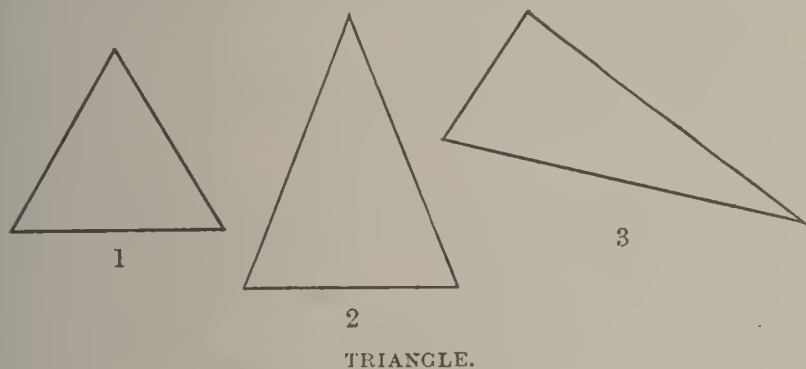
Trevelyan, SIR GEORGE OTTO, son of Sir Charles Trevelyan, Governor of Madras and Indian finance minister, by a sister of Lord Macaulay, was born in 1838. He was second classic at Cambridge in 1861, and four years later entered Parliament as a Liberal. From 1868 to 1870 he was a Lord of the Admiralty, in 1880-82 Secretary to the Admiralty, in 1882-84 Chief Secretary for Ireland, and in the latter year entered the Cabinet as Chancellor of the Duchy of Lancaster. For a few months in 1886 he was Secretary for Scotland, a position which he again occupied when in 1892 he became a member of the last Gladstone Ministry. In the interval he had been a Liberal Unionist for about fifteen months. Besides some brilliant squibs and light pieces, he is author of *Life and Letters of Lord Macaulay* (1876) and *The Early History of Charles James Fox* (1880).

Trèves (German *Trier*), a city of Rhenish Prussia, beautifully situated on the right bank of the Moselle, amidst low vine-clad hills, 60 miles south-west of Coblenz. Originally the chief place in the territory of the *Treviri*, a Teutonic or Celtic tribe, it became a Roman town in the days of Augustus and Claudius, and advanced so rapidly that in the 4th century it is described by Ausonius as "Rome beyond the Alps." The Roman remains are exceptionally numerous and interesting. Among the more noteworthy are the Porta Nigra (an immense gateway, perhaps erected as far back as the 1st century), the basilica, said to have been built by Constantine (now a Protestant church), the so-called "baths" (apparently the remains of an imperial palace), the piers of the eight-arch bridge over the river, which date from 25 B.C., and an amphitheatre outside the town capable of holding 30,000 spectators. To the mediæval period, when Trèves passed under the rule of an archbishop, who was also an Elector of the Empire, belong the cathedral (an interesting example of German Romanesque)

and the beautiful Liebfrauen Kirche, erected in the 13th century. In the former is preserved the famous "Holy Coat," said to have been the gift of St. Helena, which, on the occasion of its exhibition in 1891, attracted a vast concourse of pilgrims. The town contains extensive orchards, and carries on a considerable trade in wine, cattle, and timber; linen and cotton goods are also manufactured.

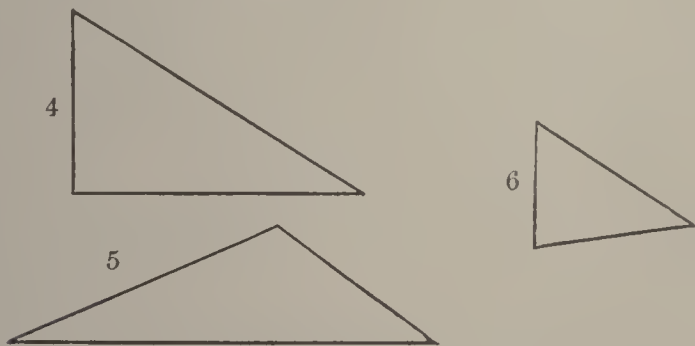
Trevor, SIR JOHN (1633-1717), was by the influence of his patron, Judge Jeffreys, elected Speaker in 1685. Soon after he was also made Master of the Rolls, and after the Revolution became a Privy Councillor. In 1690 he again became Speaker, but five years later was expelled the House for having received a bribe from the City of London. He was a man of great ability, but thoroughly venal, and found congenial employment in "managing" the House of Commons for the Ministry.

Triangle is literally a figure possessing three angles, but is often defined as a figure bounded by three lines. In plane geometry these lines are straight, and triangles are classified in accordance with the relations between the sides. When all



1. Equilateral. 2. Isosceles. 3. Scalene.

the sides are equal, the triangle is said to be *equilateral*; if two are equal, the triangle is *isosceles*; and when all are unequal it is *scalene*. A triangle possessing one right angle is said to be *right-angled*, the side opposite the right-angle being known as the hypotenuse. When one angle is greater than a right-angle, the triangle is *obtuse-angled*; and when

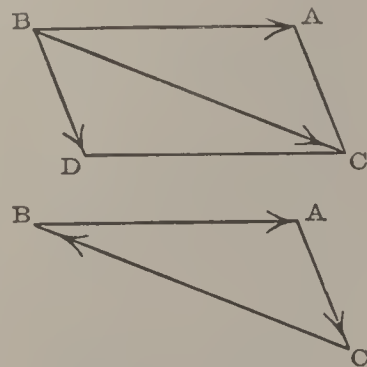


4. Right-angled. 5. Obtuse-angled. 6. Acute-angled.

all the angles are less than right-angles, it is *acute-angled*. Since the sum of the three angles is exactly two right-angles, it follows that at least two of the angles must always be acute. Plane geometry is, in reality, based upon the properties

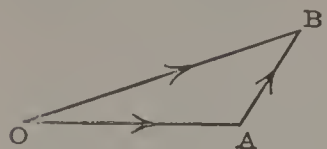
of the triangle, since the properties of other figures are generally deduced from those of this simplest figure. The longest side of a triangle is always opposite to the greatest angle, and *vice versâ*; and the connection between the sides and angles forms the basis of the science of trigonometry. The three lines drawn from the vertices to the mid-points of the opposite sides meet in a point, and this point is the centre of gravity of the triangle. The three perpendiculars to the sides drawn from the opposite angles also meet in a point which would be the centre of a circle inscribed in the triangle, while the bisectors of the three angles meet at the centre of the circle which passes through each vertex. If one side of a triangle be produced, the exterior angle which it makes with the adjacent side is equal to the sum of the two interior and opposite angles, and the three exterior angles (formed by producing the three sides in order) are together equal to four right angles. The area of a triangle is equal to half the product of its base, and the perpendicular from the opposite vertex on this base—or it may be expressed as $\sqrt{s(s-a)(s-b)(s-c)}$, where a , b , and c are the lengths of the sides, and s is half their sum. In a right-angled triangle the square on the hypotenuse is equal to the sums of the squares on the two sides; thus a right-angled triangle can be drawn whose sides are 3, 4, and 5 inches respectively, the squares on the sides being 9 and 16 square inches, while that on the hypotenuse is 25 square inches. In spherical trigonometry triangles are considered whose sides are portions of circles, and these are obtained by drawing figures on a sphere. The simplest spherical triangles are those whose sides are portions of *great* circles. The geometry of spherical triangles is naturally of great importance, on account of its application in measurements on the earth and in navigation.

Triangle of Forces is a deduction from the parallelogram of forces. [PARALLELOGRAM OF FORCES.] There it was shown that if two forces acting on a point be represented in magnitude and direction by the lines BA , BD , their resultant is represented by BC , the diagonal of the parallelogram of which BA and BD are the sides. Now the force BC will be exactly balanced by the equal and opposite force, CB ; hence CB will just neutralise the two forces BA and BD ; but BD is equal to AC ; hence CB will just neutralise BA and AC , or the three forces BA , AC , and CB are in equilibrium. These three forces are completely represented by the three sides of the triangle BAC , and, as the arrow-heads show, they are taken *in order*. Hence it follows that if three forces acting at a point can be represented in magnitude and direction by the sides of a triangle taken in order they will be in equilibrium.



TRIANGLE OF FORCES.

Triangle of Velocities is merely a modification of the parallelogram of velocities. Thus if the line OA represents a velocity, v_1 , in magnitude and direction, and if from the end A of this line another line, AB , be drawn to similarly represent a second velocity, v_2 , then the line OB of the triangle OAB will represent the resultant of v_1 and v_2 . [PARALLELOGRAM OF VELOCITIES.]



TRIANGLE OF VELOCITIES.

Triangulation is the process of dividing any portion of the earth's surface into triangles, from the measurement of which maps may be constructed. The first step in the process is to choose a suitable horizontal line, called the base-line (q.v.), and to measure it very accurately, a length of about five miles being generally a convenient distance to work with, if the peculiarities of the district will allow the possibility of such a line being obtained. From the ends of this base-line a certain point is observed, the angles between the base-line and the lines joining its ends with the chosen point being measured by a theodolite (q.v.); the distance of this point is then obtained by calculation. Working in this way, any fixed pair of points can be taken as a new base-line, and so a number of triangles can be built up. In ordinary topographical survey it is usual to select convenient points—such as the peaks of mountains—very far apart, so that large triangles are obtained. These are called primary triangles, and are subdivided into any number of smaller or secondary triangles. The side of a primary triangle may be only a few miles in length, or may exceed 100 miles. When very distant points are to be observed, they are often marked by strong limelight in dull weather, or by some arrangement for reflecting solar rays in sunny lands. The selection of convenient spots in triangulation is not always a very simple matter. Angles as near sixty degrees as possible are the best to measure, greater errors creeping in where calculations are made from very acute angles; the nature of the country, however, often interferes to prevent the possibility of this arrangement, and familiarity with the district in question is the only guide to the selection of the most suitable stations. To prevent the multiplication of errors new base-lines are chosen every now and then, their lengths calculated by continuous triangulation from the old base-line, and then actually measured. If the two results agree, the intermediate survey is accepted as accurate. It must be remembered that the surface of the earth is curved, so that the aid of spherical trigonometry must be invoked in the calculations. This will perhaps be better appreciated by considering the case where the survey of one country is connected with that of another across the sea—as in the triangulation necessary to connect the survey of England with that of Ireland, and of the Continent—the curvature of a watery surface being more apparent than that of a land covered with irregularities. An important piece of triangulation is that

necessary in measuring an arc of the meridian for the determination of the length of a degree of latitude at any place. In this case only a few triangles are necessary, but astronomical observations are made—usually on the sun or the pole-star at certain definite times—in order to fix the position of the meridian itself. [ORDNANCE SURVEY.]

Triassic System, the lowest of the three great systems into which Secondary Rocks (q.v.) are divided, so named from its divisibility into three in the Harz Mountain area, where it was first described. It can generally, however, be better divided into four parts, known (in downward succession) as the Rhætic beds, the Keuper Marls, the Muschelkalk, and the Bunter-Sandstein, each of which is described separately. The Trias is essentially a great series of sandstone, the salt-lake origin of which, at least in its upper portions, is indicated by associated beds of rock-salt and gypsum. Resting commonly horizontally over the folded Carboniferous rocks, it was formerly classed with the Permian (q.v.) as the New Red Sandstone; but in Germany, though less markedly in England, the two are separated by unconformability, and there is a decided difference in the character of their fossils. In England the outcrop of the Trias forms an interrupted band from Exmouth, along the Severn valley towards Derby, where it is divided by the Pennine anticlinal, one half extending westward over Staffordshire and Cheshire to the mouth of the Ribble, and the other eastward through Nottingham and Yorkshire to that of the Tees. Deep borings show the Trias to thin-out in a south-eastern direction. The copper of the Keuper, rock-salt, as at Droitwich, and gypsum, are its chief economic products; but the coal-beds of Virginia and Carolina belong to this period, and coal is often worked from beneath it, as in the Lancashire and Cheshire coalfield. It is one of the best water-bearing series in England, and yields also some very valuable agricultural land. Fossils are mainly confined to the Muschelkalk and Rhætic. *Equisetites* is the most characteristic plant, and *Ceratites nodosus*, the most characteristic cephalopod of the period, in which a certain mingling of Palæozoic and Mesozoic molluscs is noticeable. The amphibian *Labyrinthodon*, the crocodilian *Stagonolepis*, and other reptiles (especially in the Elgin sandstone), footprints possibly avian, and the minute marsupial teeth that form the earliest indication of mammalian life, are the chief other remains of importance.

Tribe, an aggregate of families, more or less closely related. Tylor says, "Kinship is so thoroughly felt to be the tie of the whole tribe that, even where there has been a mixture of tribes, a common ancestor is often invented to make an imaginary bond of union."

Trichina, a genus of Nematode worms, containing several species, of which *Trichina spiralis* is the best known. This lives in the muscles of the pig and rabbit, usually occurring in great numbers, and each worm being contained in a small cyst, from about a fiftieth to a seventieth of an inch in

length. The worm lies coiled up in the cyst. In this condition the worm is immature, the sexual organs being undeveloped. If meat containing living *Trichinæ* is eaten, these develop in about forty-eight hours into mature sexual forms. The males are about one-sixteenth of an inch long, and have two small processes on the tail; the females are nearly twice as large. At the end of a week the females begin to hatch broods of embryos. These are cylindrical in shape, and bore through the walls of the intestine into the muscles of the body, where they become encysted. They produce the disease known as "Trichinosis," which is common in Germany and America, but rare in England. Nothing can be done to the *Trichinæ* that have got into the tissues, but the worms in the intestine can be killed off by castor oil, calomel, etc. The chief symptoms of this malady are fever with digestive disturbance, and muscular swelling and pain; dropsy is often present, and hoarseness and difficulty of breathing sometimes occur. The mortality is generally high, and death may occur at the end of three or four weeks.

Trichinopoli, the chief town of a district of the Madras Presidency, at the head of the delta of the Kaveri, 190 miles south-west of Madras. The fort stands on a granite peak, 500 feet above the plain. St. John's church contains the tomb of Bishop Heber (1783-1826).

Trichome. [HAIRS.]

Trichoptera, an order of insects including the Caddis Flies (q.v.), the members of which are characterised by having four similar wings, which are approximately equal in size. The mandibles are rudimentary, and the larva lives in a case or "caddis tube" made of sticks, shells, etc.

Tricuspid Valve. [HEART.]

Tricycle. [CYCLING.]

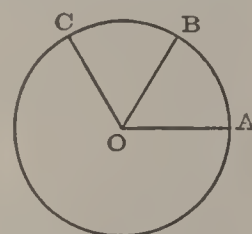
Trieste, the chief port of the Austrian Empire, situated on the Gulf of Trieste, at the head of the Adriatic Sea, 45 miles south-west of Laibach. The old town consists of narrow, irregular streets, climbing up the sides of a steep hill, on the summit of which is a castle (1508-1680). The cathedral, which belongs chiefly to the 14th century, retains portions of a Roman temple. From the old to the new town runs the Corso, a broad, handsome thoroughfare. The Tergesteo (1840), a magnificent building in the new town, comprises an exchange, reading-room, shops, etc. The harbour, which is large and commodious, has recently been much improved.

Triforium, a gallery above the arches of the nave, choir, and sometimes of the transepts of a church.

Trigonellites, a genus once proposed for some calcareous plates found in the Cretaceous and Oolitic rocks, in association with *Ammonites*. They are now known to have been parts of *Ammonites*, formed by calcification of part of the "hood," and used to close the mouth of the shell when the animal is withdrawn into it.

Trigonia, a genus of bivalved mollusca or Lamellibranchiata (q.v.), which is the type of the family *Trigoniidae*. The shell is trigonal in shape, with a short rounded anterior side, and long, obliquely truncated posterior side. The latter is flattened on the upper margin into a specially ornamented "area," part of which is marked off into an "escutcheon." The genus commenced in the Lias, and is most characteristic of the Oolitic rocks. In the Cretaceous species are still abundant, but they are rare in the Tertiary. The only living forms occur in the Australian seas.

Trigonometry derives its name from two Greek words meaning to measure a triangle, and originally that was the object of the science. Now, however, its range is much wider; it deals with angles and their measures, with their geometrical properties, and with algebraical investigations in which they are concerned. Angles are measured in three different ways, according to the unit selected. In the English system a right angle is divided into 90 equal parts, each of which is called a degree, and the degree is the unit of angular measurement. The French divide the right angle into 100 parts, and denote the unit the grade. A third system, however, exists, which does not depend upon any arbitrary mode of division. Thus if O be the centre

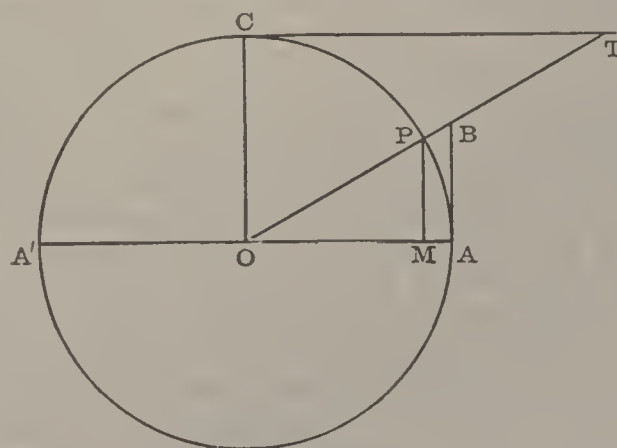


TRIGONOMETRY.
Fig. 1.

of a circle (Fig. 1), and the arc AB be taken equal to the radius OA , the angle AOB is the unit of this system, and is sometimes called a *radian*. Any angle may be expressed in terms of this unit, and the result will be the circular measure of the angle. The radian is equivalent to $57.2957 \dots$ degrees. The number of radians contained in any angle is easily seen to be the length of the arc of any circle subtended by the angle (placed at the centre), divided by the length of the radius of the circle.

Thus the circular measure of AOB is $\frac{AC}{OA}$.

Trigonometrical calculations with regard to an angle are generally made with the use of certain



TRIGONOMETRY.
Fig. 2.

ratios between the sides of a right-angled triangle containing the angle, these ratios being known as the trigonometrical functions of the angle. In former times, however, these functions had a somewhat

different meaning. Let PA be an arc of a circle whose centre is O (Fig. 2). Produce OP , draw PM perpendicular to OA , and draw AB , the tangent, at A . Let OC be perpendicular to OA , and let the tangent at C meet OP produced at T . Then PM was called the *sine* of the arc PA , OM its *cosine*, BA its *tangent*, TC its *cotangent*, OB its *secant*, OT its *cosecant*, and MA (or $1 - \cos$) its *versed sine*. In modern trigonometry these terms are applied to the ratios between the lines of the triangle OPM containing the angle POM . Thus

$\frac{PM}{OP}$ is the sine of the angle POM , $\frac{OM}{OP}$ is its cosine,

$\frac{PM}{OM}$ is its tangent, $\frac{OM}{PM}$ its cotangent, $\frac{OP}{OM}$ its

secant, and $\frac{OP}{PM}$ its cosecant. It is seen that the

lengths of the lines in the old definitions varied with the circle taken, but the modern functions are independent of any radius. If the lengths of the lines representing the old function be divided by the length of the radius of the circle, we see that the old functions of the arc are transformed into the modern functions of the angle. The sine of the angle A is generally written $\sin A$, and the square of this is denoted by $\sin^2 A$, similar abbreviations being used for the other functions.

The trigonometrical ratios are connected together by the formulæ $\sin^2 A + \cos^2 A = 1$, $\sec^2 A = 1 + \tan^2 A$, and $\operatorname{cosec}^2 A = 1 + \cot^2 A$, so that all the ratios of an angle can be expressed in terms of any one of them.

The angle POC , the amount by which POM differs from a right angle, is called the *complement* of POM and POA^1 ; the difference between it and two right angles is called its *supplement*. The functions of an angle are always the co-functions of its complement, e.g. $\sin A = \cos (90 - A)$, while the functions of an angle and its supplement are either equal or differ only in sign.

Geometrically, we can only find the functions of angles of 30° , 45° , 60° , 36° and 72° , but formulæ have been arrived at by which the functions of an angle $A + B$ or $A - B$ can be obtained from the functions of the two angles A and B . It follows that the functions of $2A$, $3A$, etc., and in the same

way $\frac{A}{2}$, $\frac{A}{4}$, etc., can be found. and so the functions of

any angle can be obtained. The solution of triangles is an important branch of trigonometry, on account of its application in mensuration and surveying, and different methods are used, according to the data given, a fundamental proposition connecting the sides and angles of any triangle being that the sides are proportional to the sines of the opposite angles. On the more theoretical side, trigonometry concerns itself with the summation of sines, whose terms are related to the trigonometrical ratios, with the expansion of certain expressions, such as the expansion of $\sin a$ and $\sqrt{\cos a}$, in series of powers of a (given in circular measure), with the evaluation of π (the ratio between circumference and diameter of a circle), and with innumerable other achievements of mathematical importance. Spherical trigonometry is that branch of the science which is

applied to the investigation of triangles drawn upon a sphere, and finds its special application in astronomy.

Trilobites, an order of Arthropoda (q.v.), all the members of which are extinct and limited to the Palæozoic rocks. The order is of interest from its importance to the geologist, the variety of forms belonging to it, and the doubts as to its correct zoological position. The body consists of three divisions, a head, thorax, and tail or abdomen, which are distinctly marked off from one another. It is distinctly trilobed in most genera, there being a raised central area with a lower flat area on either side. The thorax is always composed of a number of distinct somites, varying from two in the small *Agnostus* to as many as twenty-six in *Harpes*; each somite consists of a central raised axis with a rib-like pleura on either side. The head or cephalic shield is composed of several somites fused together; the central portion or "glabella" is raised, and covers the stomach; on either side are two pairs of plates called the fixed and free cheeks. The free cheeks are often continued backward into long spines as in *Trinucleus*. On the upper surface of the head are usually a pair of eyes; these are sometimes compound and of great power, and in some there may be as many as 15,000 facets in each eye. On the under surface of the head is a lip-plate or hypostome much like that of *Apus*. The tail or caudal shield or "pygidium" consists of several somites fused into a single plate; it often ends in a point or spire; the anus opens at the extreme end. As regards the structure of the soft parts and organs on the under surface very little is known. As the Trilobites could mostly roll themselves up into a ball, like the wood-louse, the appendages are sometimes preserved, but so much displaced that their interpretation is very difficult. It is thought, however, that one or two pairs of spiral gills occurred on each somite under the pleuræ of the thoracic region, and that each somite had also a pair of crawling legs with an epipodite or small-jointed appendage attached to each. The systematic position of the Trilobites is very uncertain. They have been most generally regarded as Crustacea, though many weighty authorities assign them to the Arachnida. The latter view is based on their affinities to the *Limulus*, which is now generally regarded as an Arachnid. During the last few years, however, the balance of evidence seems swinging back to the Crustacean view of their affinities, owing to the growth of knowledge of the appendages and the position of the anus. In this case probably their nearest living ally is the genus *Apus*, one of the Phyllopoda. The Trilobites are restricted to the Palæozoic rocks, and range from the Cambrian to the Permian; in the Carboniferous they are represented by four genera, while in the Permian there is only a single species of *Phillipsia*. They are most important in the Upper Cambrian and Ordovician. Many of the best known forms, such as *Calymene blumenbachi* or the "Dudley Locust," occur in the Wenlock Limestone. The oldest known genera are *Olonellus* and *Paradoxides*. They are classified into nineteen families.

Trimera, a section of the Beetles, or class Coleoptera, including all those in which the tarsus, or last division of the leg, is composed of three joints. The Lady Birds are the best known examples.

Trincomalee, a town and naval station on the north-east coast of Ceylon, 113 miles N.N.E. of Kandy. It stands on the neck of a bold peninsula, which divides the inner from the outer harbour. The harbour is one of the largest and safest in the Indian seas. The town was captured from the Dutch in 1795.

Trinidad, one of the British West India Islands, the most southerly of the Windward group, between lat. $10^{\circ} 3'$ and $10^{\circ} 50'$ N., and long. $61^{\circ} 39'$ and 62° W.; area 1,754 square miles. Its figure is an almost exact square, but promontories at the north-west and south-west angles enclose the Gulf of Paria, the former approaching within thirteen miles of the coast of Venezuela. Three ranges of mountains, densely clad with forests, traverse the island from east to west, the most northerly reaching a height of over 3,000 feet. The intervening plains and valleys are fertile, and yield an abundant supply of cocoa, sugar, rum, molasses, and coffee. The remarkable pitch lake at La Brea is graphically described in Kingsley's *At Last*. Trinidad was discovered by Columbus in 1496. It has been a Crown colony of Great Britain since 1797, and is ruled by a governor, assisted by legislative and executive councils.

Trinity House, on Tower Hill, is the home of a corporation, formerly located at Deptford, originating in a society of a partly religious nature, and founded by seamen for their mutual advantage. Henry VIII. granted them a charter in 1514, and similar institutions existed at Hull, Leith, Newcastle, and Dundee. Among the duties of these bodies were the attending to lighting, buoying, and pilotage, and they possessed certain rights and privileges. The Houses at Newcastle and Leith still regulate local pilotage, and that of Hull attends to the pilots, lights, and buoys of the Humber. The London House superintends the lighting and buoying of England and Wales, and has supervision over the others. In 1836 the Trinity House acquired by purchase all private rights in lighthouses. Among the duties of the house are the licensing of pilots, the removal of wrecks, and the administration of certain marine charities. The corporation consists of a master, a deputy-master, thirteen elder brethren, eleven honorary elder brethren (who, with the master, are generally men of high social rank, *e.g.* the Prince of Wales, Mr. Gladstone, etc.), and an unlimited number of younger brethren. The deputy-master and elder brethren must have been for four years previous to their election naval commanders or masters who have been for four years upon foreign voyages, and the younger brethren must have belonged to the navy or the merchant service. Committees and sub-committees are appointed for particular purposes, and three members of the House, who must be ex-officers of the mercantile marine, sit as assessors to advise the Court of Admiralty upon nautical points.

Trinucleidæ, a family of Trilobites (q.v.), in which the head shield is greatly developed, and the two hinder angles of it are prolonged back as spines. The type-genus *Trinucleus* is most abundant in the Bala beds of North Wales, while the family is entirely restricted to the Silurian and Ordovician systems.

Triple Alliance, (1) a league formed by England, Sweden, and the Netherlands in 1668 against France; (2) an alliance formed between Germany, Austria, and Italy in 1883 to check Russia.

Tripoli. [DIATOMS.]

Tripoli, a vilayet of the Turkish Empire, stretching along the Mediterranean from Egypt on the east to Tunis and Algeria on the west, and bounded on the south by the Sahara. Its area, including Barca (q.v.) and Fezzan, is estimated at some 390,000 square miles, but its limits are not very strictly determined. Beyond the level tract along the coast, which in the neighbourhood of Tripoli and Misratah is extremely fertile, stretch vast sandy plains, traversed by two rocky chains, with a maximum height of 4,000 feet, which join the Atlas range near Kairwan. The rivers are few and small, and the springs often fail. The fertile districts on the coast produce corn, fruit, wine, cotton, madder, tobacco, etc.; the dates, which grow further inland, surpass all others in North Africa. The activity of the caravans has diminished considerably owing to the suppression of the slave trade, but large quantities of ivory, gold-dust, esparto grass, and ostrich feathers are still exported. The inhabitants are mostly Berbers, with an admixture of Moors, Arabs, Turks, Jews, and a few Europeans (mostly Maltese). TRIPOLI, the capital, is a dirty town, thoroughly Moorish in character, situated on a low rocky promontory, extending into the Mediterranean and forming one side of a small bay.

Trireme, an ancient kind of ship, or rather galley, propelled, as its name denotes, by oars arranged in three tiers. The lowest bank of oars was the shortest, and the other two were of proportionately increasing length. In the Persian and Peloponnesian Wars the trireme was the largest vessel employed, but it was superseded by larger vessels, carrying four and five banks of oars. The Carthaginians and Romans used quinqueremes, and in the naval battle of Actium ships with nine and ten banks of oars were employed. In favourable weather rowing was aided by the use of a square-sail. In the earliest period of the trireme crews tried to grapple and then board the enemy, but the Athenian method was to ram. Twenty sailors, as many soldiers, and a hundred and sixty rowers formed an Athenian crew.

Tristan da Cunha, the largest of three small islands in the South Atlantic, in lat. $37^{\circ} 6'$ S., long. $12^{\circ} 16'$ W. The surface is mostly rugged and mountainous, with a volcanic cone of 7,640 feet in the centre. It takes its name from the Portuguese navigator who discovered it in 1506. The island

has belonged to Great Britain since 1816. The settlers supply stores to whalers.

Tristram, or TRISTAN, the hero of a Celtic romance, the first extant relic of which dates from the middle of the 12th century. Tristram, a minstrel and nephew of Mark of Cornwall, having been sorely wounded in a combat, is cured by the fair Ysonde or Yseult, daughter of the King of Ireland. Mark, hearing his account of her beauty, sends him to bring her to Cornwall to be his bride, which she becomes. On their way, however, both Tristram and Ysonde had drunk of a love potion, so that their hearts were united for life. Tristram, although afterwards he marries Yseult of Brittany, sends for his old love when he is once again wounded, but dies before her arrival. King Mark, learning their story, buries them in one grave, over which grew, intertwined, a rosebush and a vine. The chief mediæval forms of the story are contained in the German *Tristrant* of Eilhard of Oberge and the *Tristan und Isolde* of Gottfried of Strasburg, the English poem *Tristrem* (about 1300), and the Norse *Tristrams Saga ok Isondar*. Malory also embodied it in the *Morte d'Arthur*. Italian and Spanish versions appeared in the 16th century, and in more recent days the subject has been again treated by Wagner, Matthew Arnold, and Mr. Swinburne, among others, and by Tennyson in the *Idylls of the King*.

Triton, in Greek mythology, was the son of Poseidon and Amphitrite. His descendants were a kind of mermen, accompanied Poseidon, blew on conches, and had for special duty the calming of the sea. In the time-honoured ceremony of "crossing the line," Neptune, when he boards a ship, is accompanied by Aphrodite and by Tritons.

Trochee, a foot of two syllables, the first long or accented, and the second short or unaccented.

Trochosphere, the name of a form of larva passed through by many worms and molluscs. It is a small free-swimming body. It consists of a comparatively large lobe in front of the mouth and a long tapering tail; at the base of the lobe is a ring of cilia, while another ring often occurs on the tail. The mouth is on the ventral surface, and leads to a short œsophagus, stomach, and intestine; the last opens to the exterior by an anus at the posterior end of the body. The body cavity of the larva is an archicœle (q.v.). The body of the adult is formed from the region behind the posterior circle of cilia; the rest of the larva is absorbed or thrown off.

Trochu, LOUIS JULES, general, was born in 1815 at Le Palais in Belle-Ile. He won his first laurels in Algeria, commanded a brigade in the Crimea, and at the battle of Solferino was at the head of a division. He next became Minister of War, but made enemies by a pamphlet in which he pointed out the weakness of the army under the Second Empire. In the Franco-German War he was Governor of Paris and charged with its defence. He retired from the service in 1872, and devoted himself to the defence of his reputation.

Troglodytes (CAVE-DWELLERS) were an ancient race who, like prehistoric man, dwelt in caves, and seem to have attained but a low degree of civilisation. They were found in South Egypt and Ethiopia, in the Caucasus and along the lower course of the Danube, and in Asia. From ancient writers we learn that they lived by herding, hunting, and robbing, that their language was inarticulate, that they practised community of wives, and that their habits were repulsive.

Trogon, any bird of the Picarian family *Trogonidae*, with seven genera, mostly South American, but one genus is African and another Asiatic. They are of moderate size, with thick puffy plumage of brilliant hues, often delicately banded with white. They are forest-haunting birds, and rarely quit the branches of trees, except to feed on fruit or to seize some insect as it darts by. The best-known species is the Quesal or Resplendent Trogon (*Pharomacrus mocinno*) from Guatemala, in which "the tail-coverts are enormously lengthened into waving plumes of rich metallic green, as graceful and marvellous as those of the Paradise birds."

Trogontherium, a gigantic fossil beaver of Pleistocene times, the remains of which have been found in the Cromer Forest-bed and at Taganrog and Odessa in Southern Russia.

Troll, a Scandinavian mythological term which has been used in different senses. It was originally applied to gigantic supernatural beings, then to witches, and now generally denotes a mountain dwarf with some of the attributes of a brownie and some of a kobold.

Trollope, ANTHONY (1815-82), the novelist, was the third son of a barrister and a lady who was in her day a popular novelist and authoress of *The Domestic Manners of the Americans* (1832). Educated at Winchester and Harrow, he entered the Irish postal service in 1841, and travelled in America, Egypt, and the West Indies in connection with his duties, which he resigned in 1867 in order to give his whole energies to literary work. He had begun writing novels some twenty years before, and had in 1855 first succeeded with *The Warder*. His best works, *Barchester Towers*, *Framley Parsonage*, *Orley Farm*, and *The Last Chronicles of Barset*, with their inimitable pictures of ecclesiastical life, were produced before 1867. Among the best of his later books were *Phineas Finn* (1869), *A Life of Cicero* (1880), and an *Autobiography*, published posthumously. His elder brother, THOMAS ADOLPHUS (1810-92), lived chiefly in Italy, and was author of *The Girlhood of Catherine de Medicis*, several novels, and *What I Remember* (1887-89). He collaborated with his wife in *Homes and Haunts of the Italian Poets* (1881).

Trombone (formerly called in England the "sackbut") is a musical instrument of the trumpet kind, consisting of bent tubes, one of which slides upon the other, and ending in a bell mouth. The instrument is held by one hand by means of a cross-piece, and the other hand manipulates the

slide. The trombone is a "perfect instrument"—*i.e.* by means of the slide it produces a full chromatic sequence. Its varieties are treble, alto, tenor, and bass, and it is available both for orchestra and military band.

Tromp, the name of two great Dutch admirals. (1) MARTIN (1597–1653) gained his first successes against the Spaniards in the Thirty Years' War. In the first Dutch war with England he was the great antagonist of Blake, over whom, on November 30, 1652, he won a great battle in the Straits of Dover, after which he is said to have sailed the Channel with a broom at his masthead. In the following February he lost a three days' fight off Portland, and was killed in a battle with Monk on July 31 off the coast of Holland. (2) CORNELIUS, his second son (1629–91), served under Ruyter in the second war with England. He was a partisan of William of Orange, who on Ruyter's death made him head of the Dutch fleet. He gained distinction in the war against France and in the Danish war against Sweden. He was ennobled by Charles II. on his visit to England in 1675.

Trona consists of a hydrated acid carbonate of sodium of composition $\text{Na}_4\text{H}_2(\text{CO}_3)_3 \cdot 2\text{H}_2\text{O}$, which occurs as an efflorescence on the soil, chiefly in the neighbourhood of saline lakes in Egypt, Thibet, Asia Minor, and Siberia. It may be obtained crystallised in fine rhombic prisms, and has been known and employed for very many centuries.

Trondhjem, or THRONDHJEM, a town of Norway, at the mouth of the Nid, on the south shore of the Trondhjem Fjord, 250 miles north of Christiania by railway. The streets are broad and regular, with well-built houses, mostly of wood. The cathedral, dating chiefly from the 12th and 13th centuries, was almost wholly destroyed by a succession of fires, but it has recently been restored; it is the place of coronation of the kings of Norway. Copper ore, timber, oil, and salt fish are exported. Trondhjem, originally Nidaros, was founded by Olaf Tryggvason in 996.

Trophosome, the name applied to the whole of the nutritive zooids or hydranths in such a Hydroid as the Sea-fir (q.v.) or Sertularia.

Tropic Acid is an acid of composition $\text{C}_9\text{H}_{10}\text{O}_3$, which may be obtained in colourless needles, melting at 117° . It is important in the syntheses of many aromatic compounds, and is interesting as a primary product of the decomposition of the alkaloid *atropine*.

Tropic Bird, any bird of the genus *Phaëthon*, type of a family (*Phaethontidae*), with three species, from the tropical parts of the Atlantic and Pacific Oceans. In general appearance they are tern-like, but the central tail-feathers are extremely long. The general plumage is white, but in one species (*P. phœnicurus*) the tail-feathers are bright-red. These birds have great power of flight, and live almost entirely on the wing.

Tropics, the portion of the earth's surface which lies between the tropics (or turning-places)

of Cancer and Capricorn, these two parallels marking the extreme northern and southern limits of the sun's apparent path. The tropics have a great degree of heat, and an almost uniform climate, and constitute the torrid zone. The two tropical lines are $23\frac{1}{2}$ degrees N. and S. respectively of the equator, but their position varies slightly from time to time.

Trotting, as a specially-cultivated pace, is more in vogue in America than in Great Britain or in Europe, though the best strain of American blood comes from trotting-horses introduced from the English county of Norfolk. Russia, too, has cultivated trotting. A horse is trained to trot by the use of toe-weights, and is worth in America and Canada from £50 to £20,000, according to his breed and degree of excellence in performance. The best blood is descended from a gray stallion called Messenger, who was imported from England in 1788; and his descendant Hambletonian (champion trotter of 1849) had also a strain of Bell-founder, who came from Norfolk. At Haarlem in 1806 a speed of one mile in 2 min. 50 sec. was attained, but in 1891 the mile was covered in 2 min. $8\frac{1}{4}$ sec. Hawley Smart, in *Sunshine and Snow*, gives an account of a trial trot of the horse Greybeard, whose performance later in the race brought "the Chirper" to financial grief.

Trout, a popular name for the smaller fishes of the typical group of the Salmon family, as distinguished from the Charr (q.v.), the technical difference being that the Salmon and Trout have teeth on the head and body of the vomer, while in the Charr teeth occur on the head of the vomer only. The Common Trout (*Salmo fario*), a well-known food and game-fish, has a wide distribution in the Old World. It is plentiful in Britain, and in the streams and rivers of Northern Europe. The trout, for its size, is more stoutly built than the salmon, though without losing its symmetry; the tail is forked in young fish, but in old ones the forking is lost, and the tail becomes square or somewhat rounded. The general ground-colour is yellow, with small spots of black and red on the upper surface, and white or yellowish, with a silvery tinge, beneath. The ground-colour of the upper surface varies greatly, according to the nature of the stream in which the trout live, and to some extent they have the power of assuming the coloration of their surroundings. They are extremely voracious feeders, and nothing in the way of animal food seems to come amiss to them. Their principal diet, however, consists of small crustaceans, especially fresh-water shrimps. They also take large quantities of fish-fry, and their habit of rising for flies is well known. The tint of the flesh varies from pink to white, probably from the nature of the food. Trout vary greatly in size, a fish of a pound or a pound and a half being considered a fine one; very much larger specimens, however, are recorded. One taken in Loch Stenness in 1888 scaled 29 lb.; and in 1894 one was taken in Lough Ennell that weighed 26 lb. 2 oz., and measured $34\frac{1}{4}$ inches in length, and $28\frac{3}{4}$ inches in the middle girth. These exceptionally large

fish are by some referred to another species—the Great Lake Trout (*S. ferax*), while others hold that the so-called Great Lake Trout are only abnormally large specimens of the common species. Lochleven has a distinct species (*S. levenensis*) with pointed pectoral fins. These fish are also bred artificially, and a very large number of fry are hatched out yearly. The Geneva Trout (*S. lemanus*) is closely allied to the Salmon-trout (q.v.). The close time for trout in England and Wales is from October 2 to February 1, and in Ireland from September 29 to the end of February. There is no close time in Scotland. America has several species of trout, and the name is there also applied to Charr.

Trouvere, a Northern France counterpart of the Provençal troubadour, fulfilled much the same function. He travelled from court to court, or castle to castle, chanting his songs of war, and chivalry and love, sometimes attended by a *jongleur*, who vamped an accompaniment for him, and sometimes accompanying himself upon the harp. Taillefer (who fought at Hastings) and Blondel (friend of Richard I.) were trouveres.

Trover (from the French *trouver* = “to find”), a form of action adopted to try a disputed question of property in goods and chattels. It is called “trover” because it is founded upon the supposition (generally a mere fiction) that the defendant found the goods in question, and the allegation is made by the plaintiff that he (the defendant) converted them to his own use (such conversion being the true gist of the action), and then he claims damages for the injury sustained by such wrongful conversion.

Troy. 1. The excavations of Dr. Schliemann, begun in 1870, have brought to light a prehistoric town of the Stone Age, which some scholars regard as unquestionably the city of Homer’s *Iliad*. Recent critics had rejected the tradition that its remains lay beneath the mound of Hissarlik, which is situated near the southern shore of the Dardanelles, to the east of Besika Bay. On digging below the surface of the mound, various remains were discovered, deposited in at least five, probably six, strata. Of these there can be no doubt that the uppermost is the Novum Ilion of the Romans, rebuilt after 85 B.C. The fifth town is larger than the two immediately above it, extending over the plain at the base of the mound, which formed the Acropolis. Both the fifth and sixth towns (supposing them to be different) belong to the Stone Age, but there are many indications that before the latter was destroyed the Bronze Age was already approaching. A hoard, which includes a silver jar (containing large gold diadems, with chains, earrings, and pendants of the same material), silver daggers, an immense number of small gold rings, and various other relics, was identified with “Priam’s treasure” by some who were favourable to Schliemann’s views. The town also bears evident marks of destruction by fire, but it cannot have been burnt down by the inhabitants of the Mycenæ discovered by Schliemann, for that is a city of the Bronze, not of the Stone, Age, and therefore much later in

date than the presumed Troy. Moreover, both the Mycenæ and the Troy of recent explorations differ considerably from the cities described in the *Iliad*. Yet Homer shows an intimate acquaintance with the geographical features of the Troad, and eminent critics still point out that his description exactly suits a strong town built on the Bani Dagħ above Bunaibârhi. A solution which has been offered is that the poem, which is probably the work of ages, embodies various elements, derived partly from tradition, partly from contemporary fact.

2. A town of New York State. United States of America, stretching for three miles along the east bank of the Hudson, 147 miles north of New York. It has large iron and steel works and shirt and collar factories; cotton and woollen goods, stoves, paper, and bells are also manufactured.

Troyes, an old-fashioned French town, formerly capital of the province of Champagne, and now of the department of Aube, situated on the Seine, 104 miles E.S.E. of Paris by railway. The cathedral was originally founded in 872; the oldest part of the present structure dates from 1206. There are several other mediæval churches. The abbey of St. Loup contains a good museum and a library of some 100,000 volumes, with a large collection of MSS. Cotton, linen, and woollen goods are manufactured. The town is the centre of an agricultural district.

Troy Weight may have taken its name from Troyes, where a celebrated fair was held, it being customary for many towns to have special weights, some of which became standards in large districts. It was probably brought into England from France in the time of the Black Prince. The name may, however, have been derived from Troynovant, the monks’ name for London. There was, however, a pound of twelve ounces in use from very early times—long before the name troy was applied to it—but there were also other pounds, *e.g.* the merchant’s pound (probably giving rise to the avoirdupois weight), and the Tower pound. The troy pound is mentioned in the reigns of Henry V. and Henry VI., in the years 1414 and 1423. In 1495 Henry VII. determined to standardise the pound troy, and caused copies of it to be given to knights, burgesses of boroughs, and other important men, “to be by them conveyed to certain cities, etc., appointed for the safe custody of the same” (Ruding’s *Coinage of Great Britain*, vol. i. p. 295). But in the next year these weights were found to be wrong, and “it was then ordained that every pound should contain twelve ounces of troy weight, and every ounce twenty sterlings, and every sterling be of the weight of thirty-two corns of wheat that grew in the midst of the ear of wheat, according to the old laws of the land” (*op. cit.*, i. 295, from a statute in the twelfth year of Henry VII.). It was customary for people to take bullion to the mints—of which there were several in olden times—and have it coined on payment of a certain fee, and in these cases either the troy or Tower pound was used. But in a proclamation given on November 5th, in the eighteenth year of Henry VIII., it was ordered that the pound Tower should be no more used, but that all gold and silver should be weighed

by the pound troy, "being of twelve ounces, and heavier than the Tower pound by three-quarters of an ounce" (*op. cit.*, p. 305). A fee of two shillings and ninepence was paid for the coining of every pound troy of gold. Before the Conquest we find that the weight of a penny was to be thirty-two corns of wheat, and also that this is the same actual weight as the twenty-four grains troy mentioned in 1280 (Edward I.). The troy grain is, therefore, not the weight of a grain of wheat, but it is found to be the weight of a corn of barley, three grains of barley being equal in weight to four grains of wheat. The troy ounce was raised from the 432 grains troy of the Romans to 480 by the apothecaries, who found that the latter number of grains more easily lent themselves to division into drachms and scruples. The pound troy is divided for precious metals into twelve ounces; each ounce contains twenty pennyweights, each pennyweight twenty-four grains; but for drugs the ounce is divided into eight drachms, each drachm into three scruples, and each scruple into twenty grains. The troy pound and ounce are, however, little used now for medicines, drugs being bought by avoirdupois weight, and only prescriptions being made up by apothecaries' weight. The troy pound contains, as we see, 5,760 grains, while the avoirdupois pound contains 7,000. The use of the pennyweight and grain is gradually dying out, dealers in precious metals having largely adopted the decimal division of the ounce.

Truck System, THE, which prevailed largely in mining and manufacturing districts till forbidden by law, consisted in paying wages partly in goods instead of money. A master would open stores, and either compel his men to take part of their pay in goods, or at least make it necessary for them to buy their goods at these stores. The objectionable features of the system were the facility it gave to the men to anticipate their wages and the temptation it gave the masters to supply inferior goods. However, any system of credit seems open to the same objection, and the true remedy would appear to be the establishment of co-operative stores, and this remedy is applied in very many places. The Truck Act of 1831 abolished the system so far as mines and factories were concerned, and an Act of 1887 extended its provisions to all workmen save agricultural or domestic servants. Mining tools, fuel, house-room, food prepared under the master's roof, and medical attendance may be provided, but otherwise wages must be paid in current coin.

True Noon is the time of noon given by a chronometer which keeps regular time all through the year. The sun does not keep regular time, the time between two successive noons as indicated on a sundial not being exactly 24 hours. The time indicated by the dial is known as apparent time. The true and apparent noons coincide four times a year—on April 14, June 14, September 1, and December 25. From December 25 to April 14 the true noon arrives before the apparent noon, the greatest difference occurring on February 11th, when the chronometer indicates 12 o'clock, while

the sundial points to 11 hours 45 mins. 28 secs. Between April 14 and June 14 the sundial is ahead, and on May 14 the difference is 3 mins. 55 secs. Between June 14 and September 1 the sundial lags behind, and on July 26th it shows a difference of 6 mins. 12 secs. From September 1 to December 25 the dial is again in front, so that when the chronometer indicates noon the sundial shows 12 hours 16 mins. 18 secs. p.m. [STANDARD OF TIME, EQUATION OF TIME.]

Truffle is practically the name of all subterranean fungi that are used for food. The truffle of English markets is *Tuber æstivum*, one of the Ascomycetes. It grows under beech, oak, birch, or (rarely) conifers, on clayey or calcareous soil, from July to November, and is black with polygonal warts externally, and brown with white veins internally. Its fragrant smell can often be detected in woods, and dogs are trained to grub it up. Its market value is two or three shillings a pound, it being inferior to the French truffle. This species (*T. melanosporum*) is more globose, browner externally, and blacker internally. It is a winter species, and is to some extent cultivated, the ground under oak-trees in Poitou and Southern France being watered with the spores. The French crop is worth £800,000 per annum. It is this species that is employed in the *pâté de foie gras de Périgord*. The Italian or Piedmontese Truffle (*T. magnatum*) is paler in colour and garlic-scented. The potato-like African Truffle (*Terfezia leonis*) also occurs in Italy. On the Continent swine are trained to hunt truffles. The rarer White Truffle (*Cheromyces meandriformis*) is sometimes sold in England; as are also the worthless "Red Truffle" (*Melanogaster variegatus*) and "False Truffle" (*Scleroderma vulgare*), which are puff-balls, *i.e.* Gasteromycetes, and not truly truffles.

Trumpet, a musical instrument of brass, silver, or other metal, consisting of a tube, bent twice upon itself, cylindrical for three-quarters of its length, but opening gradually out for the remaining quarter of its length into a bell mouth. Owing to its shape and the length of the column of air, the trumpet has a peculiarly rich sound, and the many modifications introduced during and since the 18th century, though increasing its compass have tended to take away from the beauty of the sound. These changes have been in the direction of adding pistons, slides, and valves. The trumpet is very ancient; the "lituus" was its Roman equivalent and was used for cavalry calls, and the trumpet, without complications, is still used for the same purpose. The modern form of the trumpet dates from the 15th century, and the instrument is very effective in a military band, and also for orchestral purposes.

Trumpeter, any bird of the genus *Psophia*, type of a family (*Psophiidae*) of Wading Birds, peculiar to South America. The Agami (*P. crepitans*) occurs in small flocks in British Guiana. The popular name refers to the loud call.

Trumpet-Fish, the Bellows-Fish (q.v.) called

also the Sea-snipe. The name is also applied to any of the Flute-mouths (q.v.).

Truro, a city of Cornwall, $8\frac{1}{2}$ miles N. by E. of Falmouth. It is situated at the confluence of the Kenwyn and the Allen, which run into "Truro River," a northern extension of Falmouth Harbour. The quays are accessible for vessels of 100 tons. Tin and copper ore are exported in large quantities from the neighbouring mines; and the smelting of tin is an important industry. The Early English cathedral (1880-87) is a graceful example of modern Gothic. The grammar school dates from 1546.

Trust, Trustee. A trust in its simplest form is a relation between two persons by virtue of which one of them (the trustee) holds property for the benefit of the other (the *cestui que* trust), while as regards the outer world he is for most purposes the absolute owner of it. The right of the *cestui que* trust to that benefit is enforceable as a personal right only against the trustee and those who have acquired interests in the trust property with notice of the trust. As between the trustee and *cestui que* trust, and those claiming under them, the *cestui que* trust is in effect beneficial owner of the trust property, either absolutely or with restrictions, according to the nature of the trust. As trusts were formerly enforced only in equity, he is sometimes called equitable owner. This equitable ownership or interest is assignable, except in the case of a restraint on alienation, or anticipation, or of a discretionary trust. By the Statute of Frauds all grants and assignments of trusts must be in writing, signed by the grantor or assignor. No particular form of words is required for an assignment of a trust, but it is the custom to employ the same kind of instrument and the same form of words as if the interest were legal instead of equitable. The devolution of a trust follows the rules of law applicable to a corresponding legal estate or interest. Trust property is liable to be taken in execution, and if the *cestui que* trust becomes bankrupt it *vests* in the trustee in his bankruptcy. The ownership of the trustee, on the other hand, is not subject to his debts, does not pass to his trustee if he becomes bankrupt, and is not liable to succession duty on his death. Trusts arise either by the act of the party, or by operation of law, *i.e.* implied. (1) Trusts by act of the party are either express or implied. An express trust is one created by clear words, as where A gives property to B in trust for C, or otherwise expresses a clear intention that C shall have the benefit of it. A is called the author of the trust or the settlor, testator, etc., according to the instrument by which the trust is created. (2) An implied trust is where the intention to create the trust is inferred. Thus if A gives property to B, "not doubting," "entreating," or "hoping" that B will employ it for the benefit of C, a trust is implied in favour of C, the execution of which C can enforce.

Trypsin, the name given to the substance contained in the pancreatic juice which breaks up the proteid constituents of the food. [DIGESTION.]

Tsad, or TCHAD, a fresh-water lake of the

Soudan, Central Africa, between lat. $12^{\circ} 30'$ and $14^{\circ} 20'$ N., and long. 13° and $15^{\circ} 10'$ E. Its area, which is some 10,000 square miles during the dry season, increases to 40,000 or 50,000 square miles after the rains. The eastern portion consists of an intricate mass of swampy islands, inhabited by negroes.

Tuaregs (properly *Targui*; plural *Tawárik*), the collective Arabic name of the Berbers of the Sahara, whose real name is *Imoshagh* (q.v.). Although now universally adopted by Europeans, the word *Tuareg* dates only from about the 14th century, occurring, under the form *Targa*, for the first time in the writings of Ibn-Khaldún. It is of doubtful origin, though referred by some authorities to the word *erghez*, which means "man" in the Shluh (Berber) dialect of Morocco.

Tuber, a shortened shoot with a swollen stem, and small, scaly leaves, usually developed underground, as in the potato and the Jerusalem artichoke. The buds are known as "eyes," and the plant may be reproduced by cuttings of the tubers (then known to growers as "seed-tubers"), each cutting having necessarily at least one eye. Under abnormal conditions the potato-plant will develop green tubers in the axils of its aerial leaves.

Tubercle. [CONSUMPTION.]

Tubercle, a fleshy enlargement of a root resembling a tuber (q.v.), but without "eyes," as in many terrestrial orchids, the lesser celandine, the bladder-wort, and other plants. It serves as a reservoir of reserve-material. In the orchids, for instance, in which it may be rounded or palmate, it is mainly filled by the leaf-activity of early summer and exhausted by the flowering in the succeeding year, by which time another has begun to form.

Tuberose (*Polianthes tuberosa*), a liliaceous plant of the East Indies, largely cultivated, in Southern Europe and in our conservatories, for the sake of its fragrant white flowers. Its tuberous stem sends up an aerial shoot three feet high, with lanceolate leaves and a raceme of funnel-shaped blossoms, each about $1\frac{1}{2}$ inches long, with a long perianth-tube. In cultivation the flowers are mostly double. It is much grown at Cannes, Grasse, etc., for perfumery.

Tubicola, the tube-bearing worms of the class Chaetopoda (q.v.). It includes the *Serpula*, which is very common on rocks and shells all round the English coast; in the allied *Spirorbis*, which is abundant on seaweed, the tube is also calcareous, but is coiled in a small disc. In some members of the group the tube is membranous and free, as in *Pectinaria*, and in others it is formed of sand-grains as in *Sabella*. The members of the group are all marine or estuarine.

Tubifex, the Red River Worm, a small worm living in burrows in wet sand and mud in most English rivers, and also in pools. It is about an inch in length, and has a thin, thread-like body. Its correct zoological name is *Sanuris tubifex*, though it is often called *Tubifex rivulorum*.

Tübingen, a town of Württemberg, on the Neckar, 18 S.S.E. of Stuttgart. The ducal castle, which dates from the earlier half of the 16th century, occupies a summit overlooking the town; it contains the university library of 200,000 volumes. There is a monument to the poet Uhland (q.v.), who was a native. The celebrated university was founded by Duke Eberhard in 1477, and in 1534 accepted the reformed religion. The number of students is now about 1,400. The "Tübingen School" of theological criticism, notorious for its sceptical tendencies, was founded by F. C. Baur (q.v.).

Tubiporidæ, a family of Alcyonaria, comprising the Organ-Pipe Coral or *Tubipora musica*. This consists of a series of tubes rising vertically from a disc and supported and connected by horizontal plates known as platforms. Both tubes and platforms are formed of fused spicules. No fossil representatives are certainly known, but the Palæozoic genus *Syringopora* is often regarded as allied to it.

Tucuman, a province in the north central portion of the Argentine Republic; area 13,500 square miles. The plains in the easterly and middle districts are extremely fertile. TUCUMAN, the capital, is situated on the Tala, 723 miles N.W. of Buenos Ayres by railway.

Tudor, SIR OWEN, ancestor of an English dynasty, was godson of Owen Glendower. He fought at Agincourt under Henry V., whose widow he subsequently married. On her death he was imprisoned in Newgate, but escaped and fought for Henry VI. against the Yorkists. Having been captured at the battle of Mortimer's Cross, in 1461, he was beheaded. His son Edmund, Earl of Richmond, married Margaret, a descendant of John of Gaunt by Katherine Swynford. Their son became Henry VII. of England.

Tuff, a general term for all fragmentary volcanic rocks, as distinguished from lava, which includes all the compact ones. Tuffs, therefore, range from the most fine-grained volcanic ashes to the coarsest agglomerate. Tuffs may have consolidated under water, or on land, or not at all, and are generally stratified, and not uncommonly fossiliferous. *Felsite-tuff* and *trachyte-tuff* are so named from the rocks by the disintegration of which they have been formed. *Palagonite-tuff* contains the basalt glass named from Palagonia in Sicily; *peperino* is a dark-brown earthy tuff in the Alban Hills; *trass*, a light-coloured variety, quarried for hydraulic cement-making in the Eifel; and *schalstein*, sometimes at least a diabase-tuff impregnated with carbonate of lime, described from various districts of Central Germany.

Tula, the capital of a government of Central Russia, situated on the Upa, 105 miles S. of Moscow. It is celebrated for its imperial gun-factory, and arms are also manufactured extensively by private firms. Tula also produces large quantities of *samovars* (tea-urns), harmoniums, mathematical instruments, and cutlery, and ironmongery of various kinds.

Tulip (*Tulipa*), a genus of bulbous liliaceous plants, mostly natives of Central Asia, the Levant, and the Mediterranean area. They have triennial bulbs and (except in one Asiatic species) solitary flowers. The six perianth-segments are similar, but in two whorls; the six stamens free, with erect anthers; and the trilobed stigma sessile upon the ovary, which forms a many-seeded capsule. *T. suaveolens* of the Caspian is the parent stock of the early-flowering "Van Thol" tulips; *T. Gesneriana* of Armenia, that of most of the later-flowering kinds. *T. silvestris*, a form with narrow leaves, and fragrant, pendulous yellow flowers, found apparently wild in English chalk-pits, may be a reversion-form of the latter. In cultivation tulips hybridise and vary freely, so that many hundreds of varieties exist. Over 600 acres of tulips are grown annually in Holland, chiefly near Haarlem, the exports of bulbs and flowers reaching £110,000 per annum. In the 17th century tulip bulbs became the excuse for a remarkable gambling craze known as the tulipomania, when 4,000 florins was paid for a single bulb; scrip was issued for shares in bulbs of supposed great value, and fortunes changed hands over specimens which were sometimes not seen by the buyer or were even non-existent.

Tulip-Tree (*Liriodendron tulipifera*), a lovely North American magnoliaceous tree, fossil representatives of which occur in the Miocene rocks of Europe, whilst an allied species still lives in Central China. It reaches 100 ft. to 140 ft. in height, having a smooth bark, bright-green leaves of a remarkably truncate four-lobed form, with large deciduous stipules, and tulip-like orange flowers with three reflexed sepals and six petals. The tree grows well in English gardens. In America its wood is used for Indian canoes, and in cabinet-making and coach-building, and it is now being imported in England under the misleading trade names of "poplar," "white," "yellow," or "Virginian poplar," "whitewood," or "canary whitewood." It takes stains and polishes well, and is, therefore, used in shop-fitting.

Tulloch, JOHN (1823-86), Principal of St. Andrews, was born at Bridge of Earn, Perthshire. In 1854 he was appointed primarius Professor of Divinity at St. Andrews, and in 1860 became senior principal. In 1878 he was Moderator of the General Assembly. He was the most liberal of Presbyterians. In 1864 he published in answer to Renan, *The Christ of the Gospels and Modern Criticism*, but his most important work was *Rational Theology and Christian Philosophy in the Seventeenth Century* (1872). His last book was *Movements of Religious Thought in Britain during the Nineteenth Century* (1885).

Tumour, a swelling or enlargement, due to the development of new growth in the part of the body affected. It is not usual to include under the term tumour cases of simple hypertrophy of organs, and swellings which result from inflammation or from the diseases known as the infective granulomata (tubercle, lupus, syphilis, leprosy, glanders, and actinomycosis). When the swelling consists of tissue similar to that normally present in the part

affected the tumour is said to be homologous, while it is on the other hand termed heterologous when it is made up of embryonic tissue, and is therefore dissimilar to the tissues of its place of development. Tumours are divided into two classes, *innocent* and *malignant*. The former are usually homologous, they are often encapsuled, and in their growth they remain readily separable from surrounding structures, into which they do not extend, but which they rather thrust aside. The new formation is thus, as a rule, easily dealt with by operative treatment, it being a simple matter to dissect out the tumour, and when this is completely effected there is no likelihood of recurrence. The growth of an innocent tumour is slow, and it does not cause similar growth in the neighbouring lymphatic glands, or in remote parts of the body. A malignant tumour, on the other hand, increases rapidly in size, and infiltrates the surrounding tissues—that is to say, it extends into them so that it is difficult to say where the new growth ends and where sound tissue begins. Again, it often sets up similar growth in the nearest group of lymphatic glands, and it may be in distant parts of the body. It is hence no easy matter in many cases of malignant disease to remove the morbid tissue, and if this is not effected the tumour usually recurs. Hence the great importance of dealing with malignant growths in their early stages, before the disease has become widely infiltrated, and before any secondary deposits of the growth have occurred. Innocent tumours may be composed of various kinds of fully-developed tissue, *e.g.* fatty, fibrous, cartilaginous, osseous, muscular, nervous, and vascular tissues. Malignant tumours consist for the most part of carcinomatous and sarcomatous tumours; the former (the true cancers) are of epithelial origin [CANCER]; the latter are composed of embryonic elements of a connective tissue type, and consist of cells and of a surrounding matrix. According to the shape of the cells which are present, the sarcomata are divided into the round-celled, spindle-celled, mixed-celled, and giant-celled varieties. Cysts (q.v.) are sometimes included under the designation tumour.

Tun was a measure of volume used for wine and beer, the value differing in the two cases. It is now practically obsolete. [TOX.]

Tunbridge Wells, a municipal borough and watering-place, on the borders of Kent and Sussex, 5 miles S. of Tunbridge. The chalybeate springs, situated at the end of the chief parade, called the Pantiles, were discovered by Lord North in 1606. Mount Ephraim and other Biblical names have been handed down from the days of the Puritans, and more recently the town has been a stronghold of the Evangelical party. There is a fine open common, and the surrounding country is very picturesque.

Tungsten ($W = 184$), is a metallic element, which occurs chiefly in the minerals *wolfram* and *scheelite*. The metal, which may be obtained by the reduction of the oxide in hydrogen, is of an iron-grey colour, hard, and fusible with difficulty. It is unalterable in air, except in a very finely-

divided state. Heated in chlorine, it gives rise to solid, volatile chlorides of considerable chemical interest. It forms two oxides, WO_2 and WO_3 . The last gives rise to a large number of complicated salts, the *tungstates*. Of these the normal *sodic tungstate*, $Na_2WO_4 \cdot 2H_2O$, is the most important, being used largely as a mordant in calico-printing and dyeing, and also for rendering cotton, etc., fabrics fire-proof. The metal when present to a small extent in steel communicates to it great hardness and increases its power of retaining magnetism.

Tungus, one of the main divisions of the Ural-Altaic race (q.v.), who are scattered in small groups over a vast domain of nearly two million square miles in East Siberia, between the Yenisei River and the Pacific Ocean, and at some points even reaching northwards to the Arctic Ocean. But, excluding the Manchus, the only civilised and settled members of the family, the total population of Tungus speech is estimated at not more than 50,000, and by some authorities as low as 20,000. Chief tribal groups: *Tungus proper* ("Reindeer Tungus"), widespread north of the Amur River; *Olehas* (*Manzu*), at the mouth of the Amur; *Oroks*, in the island of Sakhalin; *Negdas* and *Samaghirs*, northern affluents of the Amur; *Orochons*, of the Upper Amur; *Golds*, of the Lower Amur and Ussuri River; *Solons* and *Daur*s, of the Upper Nonni Basin; *Manchus*, now mostly assimilated to the Chinese; *Lamuts*, round the shores of the Sea of Okhotsk. Type distinctly Mongolic, marked by high cheekbones, slant eyes, yellow skin, lank black hair, low stature, great physical strength, extraordinary powers of endurance, keen sense of smell, hearing, and vision, but with a sort of colour blindness, generally confusing blue, green, and yellow; sluggish intellects, but moral qualities (courage, generosity, love of truth, hospitality) highly developed, hence described by Castrén as the "true nobility of Siberia"; are hunters and trappers in the forests, pastors on the steppes, fishers on the shores of seas and rivers. Nearly all are still Shamanists, the very word *Shaman* being of Tungus origin; even the few official Christians practice Shamanist rites, and polygamy is universal. In the Ural-Altaic linguistic family Tungus is most nearly allied to Mongolian, which it surpasses in wealth of grammatical forms. *Tungus* (properly *Tinghiz*) is their Tatar name, adopted by the Russians, but they usually call themselves *Boia*, "men." (Castrén, Hickisch, Shrenck.)

Tunicata, a class of animals forming a sub-phylum of the Chordata (q.v.), and thus allied to the Vertebrates. It includes the Sea-squirts, such as the Common Ascidian (q.v.). The animals are degenerate members of the Chordata, in which the notochord is confined to the tail. This appendage only occurs in the larva in most forms. The nervous system is usually reduced to a single ganglion. The animals are simple or colonial, fixed or free, and are hermaphrodite. They are enclosed in a test; the mouth opens to a respiratory pharynx, from which the water escapes by the mouth or an additional aperture. They are all marine. The

Tunicates were originally grouped with the Bryozoa (q.v.) and Brachiopods (Lamp-shells) to form the phylum Molluscoidea, and supposed to be closely related to the Mollusca. This has now been abandoned from a study of embryology, and the Tunicates are allied to the Vertebrates. The main connection with these is due to the relative positions of the nervous system and the notochord. This is best seen in the order Larvacea, where it is a rod of cartilaginous material lying along the tail. Above it is the nervous cord, which gives off branches to the masses of muscle (or myomeres) on either side of the tail. The same arrangement can be made out in the embryos of the other two orders, but during development the tail is reduced, the notochord lost, and the nervous system concentrated into a single ganglion. The structure of a typical Tunicate is described under ASCIDIAN. The classification of the class is as follows:—

I. LARVACEA: Simple free-swimming forms, with a tail provided with a notochord, e.g. *Appendicularia* (q.v.).

II. ASCIDIACEA: Well-developed test; large pharynx.

(1) *Ascidie simplices*: Simple or in compound colonies, but each individual has its own test, e.g. the common Ascidian (q.v.).

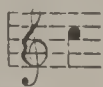
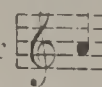
(2) *Ascidie compositae*: Fixed and colonial, with a common test, e.g. *Botryllus* (Sea Grapes).

(3) *Ascidie salpeformes*: Free-swimming colonies; the only genus is the phosphorescent *Pyrosoma*.

III. THALIACEA: Free-swimming barrel-shaped forms with thin test, e.g. *Salpa Dolium*.

Tuning-Fork is a rod of metal bent into two prongs and supported on a handle fixed at the bend. The fork can be thrown into a state of vibration by hitting it sharply against something hard or by drawing a violin bow across its prongs. The vibration can be seen if the fork be carefully observed, and the motion it sets up in the air can be detected by the hand. A sound is produced as the fork vibrates, and, the vibration becoming less and less in amplitude, the sound gradually dies away, the same note being, however, maintained since the number of vibrations per second remains unchanged, the fork merely moving a shorter distance to and fro as time goes on. The motion of the fork is beautifully shown by Lissajon's figures (q.v.), and the number of vibrations it makes per second can be experimentally determined by attaching a style to one prong and letting the style just touch a piece of smoked glass, which is allowed to move onwards with a certain known velocity. The number of little undulations made on a given length of the smoked glass [SOUND] measures the vibrations of the fork, and therefore gives the pitch of the note. [PITCH.] When the fork gives its lowest or fundamental note, there are two nodes (q.v.) in the curved portion, and the free ends oscillate about these fixed points. When the fork gives its first overtone there are two other nodes—one in each prong—as well as the two in the bend. [SOUND.] The position of the nodes can be determined by Chladni's method of placing fine sand on the fork and noticing the points at which it accumulates when the fork is made to vibrate. It is a curious fact that two tuning-forks may be in perfect unison when they produce their fundamental note, but their first overtones may be audibly discordant, and *vice versa*. Helmholtz

discovered that the number of vibrations of the first overtone was not a constant multiple of the number given by the fundamental. The vibrations of the overtone may be rather more or rather less than six times those of the fundamental. Tuning-forks are used to regulate the pitch of the notes of musical instruments. One fork, usually giving the

note  or , is used to test the accuracy of the corresponding note on an instrument; a musician generally adjusts the rest by ear.

Tunis, nominally a hereditary beylik of the Turkish Empire, but in reality a dependency of France, under the government of a resident-general. It is bounded by the Mediterranean on the north and east, Tripoli on the south-east, and Algeria on the west and south. The length from north to south is about 300 miles, the extreme breadth 150 miles, and the area 45,000 square miles. It is traversed by two chains running eastwards from Algeria, the height of the southern in some places exceeding 5,000 feet, whilst that of the northern nowhere reaches 4,000 feet. Between them lies the fertile valley of the Mejerda, the principal river of Northern Africa. The southern chain divides into two branches, separated by a mountainous plateau, from which numerous streams flow in an easterly direction, disappearing in swamps and lagoons, which are usually dry in summer. In the midst of this district stands the ancient city of Kairwan. From Tebessa southwards there is a gradual descent through a series of steppes from the mountainous region to the Sibakh or salt-marshes, which extend inland from the Gulf of Gabes. Cork woods abound towards the eastern frontier, and the fertile districts produce plentiful crops, both of grain and of oranges, olives, grapes, and other fruit; the dates grown in the Belad el Jeird in the south are among the best that find their way to Europe. The resources of the country have been but little developed, but its commercial prospects are gradually brightening under French influence. The exports include wheat, barley, fruits, olive-oil, woollen textures, tunny-fish, and sponges. TUNIS, the capital, stands on an isthmus between two salt lakes, the outermost of which (that on the north-east) communicates with the port of Goletta by means of a short canal. The chief attractions of the old town are its mosques and bazaars. The aspect of the place has changed considerably during the French occupation (which began in 1881), and sanitary improvements are being gradually introduced.

Tunnel, a way hollowed underground, whether for water passage, as in the case of canals, drains, sewers, and the like, or land passage, as in the case of railways and roads. Among ancient tunnels for water may be noted the Cloaca Maxima of Rome, Claudius's tunnel at Lake Fucino, and the tunnel by which the Bridgewater Canal communicates with the coal-pits at Worsley. But the chief use of tunnels has been in the preservation of, as far as possible, a uniform gradient upon railways when passing through hilly country or beneath a town

or river. There comes a time when to make a safe cutting would cost more than tunnelling, and then the latter is resorted to. The usual method is to sink shafts of not less than nine feet in diameter, and to work from each of these, and the difficulty and expense of the work depends upon the nature of the soil to be cut through, both of these being sometimes enormously increased by the occasional occurrence of quicksands or underground water-courses. Often the shafts are kept permanently open for the purpose of ventilation. In cutting through a mountain shafts become impossible, and here ventilation must be artificial. The tunnel of Mont Cenis was begun simultaneously at either end, and the calculations were so true that the two lines of excavation met accurately in the centre. Generally a tunnel is lined with bricks, but in a very solid soil this becomes unnecessary. In the case of the South London Electric Railway, which is tunnel throughout, the two lines pass through iron tubing, and at one point one tube passes over the other. The tunnels and subways beneath the Thames were considered wonderful feats of engineering till eclipsed by that beneath the Mersey and the wonderful tunnel, more than four miles long, beneath the Severn.

Tunny, any fish of the genus *Thynnus* of the Mackerel family, from tropical and temperate seas. There are two dorsal fins, and behind the second dorsal and the anal fin is a row of finlets. The best-known species is the Common Tunny (*T. vulgaris*), abundant in the Mediterranean, whence it ranges to the English Channel and to Tasmania. It is a large fish, specimens of ten feet long and a thousand pounds weight being recorded, but these are very much above the average size. There is a large tunny fishery in the Mediterranean. The fish are driven into funnel-nets, and when crowded together in the small end are speared or harpooned. The flesh is valued for food, and large quantities are preserved in oil for exportation. [BONITO.]

Tunstal, CUTHBERT (1474-1559), ecclesiastical statesman, was educated at Oxford, Cambridge, and Padua. He became successively rector of Harrow, Master of the Rolls, Dean of Salisbury, Bishop of London (1522), and of Durham (1524). He was much employed as a diplomatist by Henry VIII., whose position in Church matters he accepted. He was appointed a member of Edward VI.'s Council, but was soon deprived and sent to the Tower. Restored by Mary, he was finally deprived by her successor for refusing the oath of supremacy.

Tupi, the north-eastern division of the Guarani family, who, under a multiplicity of names, formerly occupied a great part of the maritime and Amazonian provinces of Brazil. The chief branches are the Tupi proper of Bahia; the Tapuyos on both sides of the Amazons; the Tupinambas and Tupinambaranas in the Rio Real basin; the Tammimivis and Tamoiaes of Rio de Janeiro; the Tupiniquins of Espirito Santo; the Tapiguaes between Pernambuco and San Vicente; the Tappes of Rio Grande do Sul; the Cahetes of the Lower San Francisco; and the Petiguaes of the Parahyba basin. The

Portuguese generally extend the term Tupi to all the natives of Tupi-Guarani speech. [GUARANI.]

Tupper, MARTIN FARQUHAR (1810-89), was the son of a leading City surgeon. Educated at Charterhouse and Christ Church, he was called to the bar, but very soon ceased to practise. His *Proverbial Philosophy*, published between 1838 and 1867 had great vogue for a time. Tupper, who was elected F.R.S. in 1845, invented glass screw stops to bottles and safety horse-shoes. He also published *My Life as an Author* (1886), and gave two courses of lectures in America.

Turbellaria, a class of worm known as the Planarians (q.v.). They are classified as follows:—

I. RHABDOCÆLIDA: small worms, with cylindrical or flat bodies.

1. *Acœla*, primitive forms, without intestine, and usually without nervous system.
2. *Rhabdocœla*, forms with a straight intestine, e.g. the parasitic *Anoploditum*.
3. *Alloicœla*, forms with a lobed intestine.

II. DENDROCÆLIDA, large worms with branched intestines.

1. *Tricladida*, including the best known forms, *Planaria*, *Bipalium*, etc.
2. *Polycladida*, forms with a leaf-like body, e.g. *Cotylea*.

Turbine. [WATER POWER.]

Turbot (*Rhombus maximus*), the most highly-valued of the British Flat-fishes. In this genus, to which the Brill (q.v.) also belongs, the eyes are on the left side; the scales are small or absent, the dorsal fin commences on the snout, and the lateral line takes an almost semi-circular curve above the pectoral fin. The turbot when adult is about two feet long, but larger specimens are recorded. It is fairly common round the British and Irish coasts, and the North Sea is one of the best fishing grounds. One species (*R. maculatus*) occurs on the Atlantic coasts of North America, and another (*R. maroticus*) in the Black Sea.

Turenne, HENRI, VICOMTE DE (1611-75), one of the greatest men of the age of Louis XIV., was a grandson, through his mother, of William the Silent, Prince of Orange. His father was the Duc de Bouillon. Brought up in Holland, he learned war under his uncle, the Stadtholder Maurice. He turned his lessons to good account during the Thirty Years' War, when he won the victory of Casale, and conquered Roussillon and Bavaria for France. He was made a Marshal of France in 1644. During the Fronde he at first, impelled by his passion for Madame de Longueville, took part with the nobles; but after his defeat at Rethel, joined Mazarin and became the royal champion against Condé, whom he defeated at the Faubourg St. Antoine (1652) and the Dunes (1658). He became one of Louis XIV.'s most trusted councillors, and again commanded his armies in the war of Holland. His most brilliant campaign was that of 1674, in which, with greatly inferior forces, he beat the Duke of Lorraine and the Elector of Brandenburg. In the next, in which he was opposed by the skilful Montecuculli, he was killed by a cannon ball. In 1668 he became a Catholic. Napoleon considered him the greatest of modern strategists.

Turgénief, IWAN SERGEIWITCH (1818-83), the great Russian novelist, was born of noble parentage at Orel. He was educated at Berlin as well as at the Russian universities. In 1846 he first became known by his *Annals of a Sportsman*, directed against the evils of serfdom. His liberal opinions resulted in imprisonment and banishment to his estates, and for the latter half of his life he lived abroad, first at Baden-Baden and then at Paris. He especially excelled in the short story, and he was thought very highly of by French critics, in whose language many of his works were originally written. Among his earlier tales may be mentioned *A Nest of Nobles* (or *Lisa*) and *Helene* (or *On the Ere*); of the later, *Smoke*, *Virgin Soil*, and *Annouchka* were some of the best. He also wrote poems and dramas. Like Tolstoi, he was pessimist in thought, but he had little of the later writer's sympathy with the Young Russian movement.

Turgot, ANNE ROBERT JACQUES (1727-81), a great French statesman, came of a good Norman family. He was educated at the Sorbonne for the priesthood, but ultimately entered the service of the State. During the thirteen years (1761-74) that he was intendant of Limoges he carried out the ideas of the *philosophes*, succeeded in abolishing the *corvée*, introduced the growing of the potato, and did his utmost to meet a famine which lasted two years. In 1766 he published *Réflexions sur la Formation et la Distribution des Richesses*, the best work of the physiocrat school of political economists. On the accession of Louis XVI. Turgot became first Minister of Marine and soon after Controller-General of the Finances. During an administration of less than two years he united against himself, by his attempted reforms, the courtiers, the nobility, the clergy, and the farmers-general; and the king, though he had a great respect for him, was obliged to consent to his dismissal in 1776. Turgot belonged to the school of Voltaire, and "would have effected the revolution by ordinances" had he been supported. His main objects were the abolition of forced labour (the *corvée*), of inter-provincial customs duties, of close corporations in towns (*jurandes*), and, above all, of every exemption from taxation. Turgot's life was written by his friend Condorcet; their correspondence has been lately published. In recent times M. Léon Say and Mr. John Morley have dealt with his life and doctrines.

Turin, a city of Northern Italy, formerly the capital of Piedmont, situated a little above the confluence of the Po and the Dora Riparia, 80 miles W.S.W. of Milan. The town, which has a very modern aspect, with broad, regular streets and well-built houses, stands in the midst of a rich and beautiful plain, surrounded by hills, beyond which rise the snow-clad Alps. The cathedral is a Renaissance edifice, rebuilt in 1498. Of the numerous palaces, the most interesting is, perhaps, the Palazzo Madama, built by William of Montferrat towards the close of the 13th century. The university, founded in 1400, is now attended by about 2,000 students. The manufactures include silk, woollen, and cotton stuffs, carpets, and wax

matches. Turin was capital of the kingdom of Sardinia prior to 1860, and of Italy from 1860 to 1865.

Turkestan ("Land of the Turks"), a region of Central Asia extending from the Caspian Sea on the E. to beyond Lob Nor on the W., and from Siberia and Soongaria on the N. to Persia, Afghanistan, and Tibet on the S. The area is estimated at 2,000,000 square miles. *Eastern* and *Western Turkestan* are separated by a lofty plateau, the Pamir, in lat. 39° N., long. 73° E., which recent exploration has shown to occupy the position of the fabulous Bolor Tagh. *Western Turkestan* presents very diverse natural features, the western portion consisting of a hollow plain of shifting sands, containing the Caspian and the Sea of Aral; whereas that on the east is hilly, with many fertile valleys. In the former division vegetation is to be found only in scattered oases, and along the banks of the rivers, of which the Syr-Daria, or Jaxartes (q.v.), and Amu-Daria, or Oxus (q.v.), are the most important. Politically, Western Turkestan comprises the state of Bokhara in the E. and central portions; Ferghana in the N.E., and the country surrounding Merv in the S.W., which belong to Russia; Khiva in the N.W., where Russian influence predominates; and Afghan Turkestan, consisting of Balk, Koondooz, and Badakshan. The settled inhabitants include Uzbeks (who are mainly agriculturists), Sarts, Tajiks, and Persians; but more than half the population is composed of nomadic Tatar tribes, whose chief occupation is the rearing of horses, mules, asses, camels, cattle, and poultry. The most important mineral product is the salt, which in many places covers the surface of the desert. Cereals, fruits, cotton, hemp, flax, and tobacco are grown, and there are manufactures of woollen, silk, and cotton textures, shagreen, and carpets. *Eastern Turkestan* is bounded N. by the Thian Shan Mountains, W. by the Pamir, and S. by the Kuen Lun mountains. It sinks gradually from an altitude of 4,400 feet at the base of these mountains to one of 2,200 feet on the shores of Lob Nor, a group of lakes at its E. extremity. Much of the surface is sterile, and, though there are several large towns, the region, as a whole, is sparsely inhabited. In spite of Russian intrigues, Eastern Turkestan still forms part of the Chinese Empire. Kashgar, the capital, and Yarkand both carry on a considerable trade. Turkish is the language commonly spoken, and the inhabitants are mainly of Tatar origin.

Turkey, a country of south-eastern Europe, eastern Asia, and north-eastern Africa, the extent and administration of which were greatly altered by the Berlin Congress of 1878. As now constituted, it comprises (1) Turkey proper, under the immediate government of the Sultan; (2) several tributary and semi-independent states. Turkey in Europe is bounded N. by Roumania, Servia, and Hungary; N.W. by Montenegro; W. by the Adriatic; S. by Greece; and E. by the Black Sea, the Sea of Marmora, and the Archipelago. The boundaries of Turkey in Asia are the Black Sea on the N.; Russian Armenia on the N.E.; Persia on the E.; the Archipelago and the Mediterranean on the

W.; and Arabia and the Syrian desert on the S. It is difficult to obtain trustworthy information regarding the affairs of the empire, so that the following statistics are only approximately correct.

Area and population.

	SQUARE MILES.	POPULATION.
I. Turkey (In Europe - -	61,200	4,780,000
Proper. { „ Asia - -	687,640	21,608,000
„ Africa - -	398,740	1,300,000
	1,147,580	27,688,000
II. Bulgaria and Eastern Roumelia (an autonomous province) - -	37,860	3,154,375
Bosnia, Herzegovina, and Novi-Baazr (administered by Austro-Hungary) - -	23,570	1,504,090
Samos (tributary province) - -	210	48,500
Egypt - -	400,000	6,817,265
	461,640	11,524,230
Total - -	1,609,220	39,212,230

The most populous towns are :—

	POPULATION.		POPULATION.
Constantinople -	895,470	Adrianople -	100,000
Smirna -	200,000	Salonica -	60,000
Damascus -	200,000	Erzeroum -	60,000
Bagdad -	180,000	Kaisarieli -	60,000
Aleppo -	120,000	Broussa -	60,000

Physical Features and Climate. The surface of Turkey in Europe is for the most part uneven, its mountains being a south-easterly prolongation of the Alpine system. The main branch, comprising the Dinaric Alps and Mount Pindus, runs S.W. and S. from Bosnia and Montenegro to Greece, in a line parallel to the shore of the Adriatic and the Ionian Sea. The Balkans, which branch off from this range in an easterly direction, are now situated in the principality of Bulgaria; but the Despoto Dag (7,464 feet), which forms a southern arm of the same chain, is still within the limits of Turkey proper. The Skhar Dag, in Albania, reaches a height of 10,007 feet. The principal rivers are the Moritza, Struma, and Vardar, running S. to the Archipelago, and the Drin and Voyussa, which fall into the Adriatic. The surface is generally well wooded. There is an abundance of hardy forest trees, such as the pine, birch, and oak, and the palm, maple, myrtle, and laurel flourish S. of the Balkans. In most parts the temperature changes rapidly from extreme heat to intense cold; but the climate of the Albanian valleys is less variable. The surface of Turkey in Asia is more broken than that of Turkey in Europe. The ranges of Taurus and Anti-Taurus traverse Asia Minor, sending off branches in all directions, the involutions of which form an endless series of deep gorges, lofty plateaux, and mountain-girt plains. From the eastern extremity of Mount Taurus the ranges of Lebanon and Anti-Lebanon run S. through Syria and Palestine. The mighty rivers Tigris and Euphrates empty themselves into the Persian Gulf, and the Kizil Irmak flows through the northern

part of Asia Minor to the Black Sea; but almost everywhere there is a great lack of water, and, as all attempts to preserve the ancient system of irrigation were long ago abandoned, many once fertile districts have for many centuries been waste tracts of rock and sand.

Races and Creeds. It is estimated that in Turkey



MAP OF TURKEY.

in Europe there are about 700,000 Turks and 1,500,000 Albanians. The Greek population probably does not fall far short of the Albanian. The other inhabitants are chiefly Serbs, Bulgarians, Wallachians, Magyars, Armenians, Circassians, Gipsies, and Jews. Turkey in Asia is supposed to contain some 6,800,000 Turks, 4,000,000 Arabs, 1,300,000 Syrians, and 1,000,000 Greeks, in addition to Kurds, Armenians, Circassians, Jews, and other races. The number of Mohammedans is said to be 12,000,000 in Asia, 7,000,000 in Africa, and not more than 2,000,000 in Europe. The other inhabitants belong chiefly to one or another of the numerous Eastern Churches [GREEK CHURCH], in addition to which there is a considerable number of Latins or Catholics (acknowledging Papal supremacy), besides many Jews and a few Protestants in Armenia and elsewhere.

Government and Political Organisation. The Sultan is an autocrat, but his power is limited on the one hand by the Koran, the Multeka (a sacred code embodying the views and judgments of Mohammed and his immediate successors), and the Cahon-nameh (a code drawn up by Solymán the Magnificent), and on the other by the authority of the Sheik-ul-Islam, the head of the Ulema (q.v.), and chief religious dignitary, who may impose a veto on the imperial decrees. The chief political functionary is the Sadr-azam, or Grand Vizier, who presides over a divan (the Medjliss-i-Hass), a cabinet of thirteen members. Both the Sadr-azam and the Sheik-ul-Islam are appointed by the Sultan, who in the latter case must obtain the consent of the

Ulema. The empire comprises thirty-one vilayets or provinces, each containing so many *sanjaks* or *liras*, the *sanjaks* being subdivided into *kazas*, the *kazas* into *nahiés*, and the *nahiés* into *kariés*. The vilayets are administered by governors, called *valis*, who are responsible to the Sultan alone, but act with the advice of a provincial council. For each subdivision there is a corresponding official of inferior rank. The *mutesarifs*, who govern the *sanjaks* called *mutessarifats*, are appointed immediately by the Sultan, without the intervention of the *vali*. Of late years both the judicial and the financial powers of the provincial governors have been much curtailed, and the farming of the variable taxes no longer gives scope for unlimited extortion.

Land Tenure. Agriculture, Industries, and Commerce. The soil of Turkey is fertile, but agriculture is in a backward condition, owing, among other causes to the unsatisfactory system of land tenure, the lack of adequate communication, and the practice of exacting tithe on all produce. The area under cultivation comprises—(1) *miri*, lands held immediately from the Crown and subject to the supervision of Crown officers; (2) *vacouf*, land originally set apart for purposes of religious or educational endowment, but now mostly in the hands of Government officials; (3) *mulikaneh*, hereditary possessions, originally granted as a reward for military service; (4) *mülk*, freehold property, the amount of which is inconsiderable. The products raised on these lands (the area of which is believed to be about 44,000,000 acres) include maize, barley, rice, millet, and other cereals; figs, grapes, and raisins; cotton, tobacco, olive-oil, and sesame and other oil-seeds. The orange, citron, peach, and various other fruit-trees grow abundantly in the Albanian valleys and the more fertile districts of Asia Minor; and the rearing of silkworms is again becoming a lucrative industry. The mountain slopes afford excellent pasture, and sheep are bred in large numbers for the sake of their wool. The chief mineral products are iron (which is abundant), copper, sulphur, alum, bitumen, salt, argentiferous lead-ore, and silver (in Asia Minor); some gold is found, and coal is common in certain districts, but it is little worked. The manufactures, few of which are exported, include woollen, cotton, and silken fabrics, carpets, shawls, morocco leather goods of various kinds, swords, and fire-arms. The fisheries of the Bosphorus are a source of great wealth. The value of the exports and imports amounted to about £13,655,180 and £18,937,370 respectively in 1889-90; and to £11,552,820 and £20,622,910 in 1890-91. The principal exports are tobacco, cereals, fruit (especially figs and raisins), wine, silk, opium, coffee, wool, oil-seeds, skins, valonia, mohair, cotton, carpets, drugs, and spices. Cotton and woollen goods figure prominently among imported articles. It is estimated that 43 per cent. of the imports come from Great Britain, and that 38 per cent. of the exports are sent hither. The length of the railways at the end of 1892 was 1,878 miles (904 miles in Europe and 974 miles in Asia), and that of the telegraph-wires about 20,400 miles.

Finances. The financial condition of Turkey

has long been notoriously unsound. In 1889 the revenue amounted to £T.18,500,000, the expenditure to £T.21,400,000, leaving a deficit of £T.2,900,000. A deficit of £T.1,700,000 in 1890 was reduced to some extent by increased economy in several Government administrations. The public debt amounted in 1893 to £132,555,958, exclusive of the Russian War indemnity of £32,000,000, which is paid in annual instalments of £318,180. Certain excise and other duties have been assigned in payment of the debt, and the administration of these is in the hands of an international commission, which acts independently of the other departments of Government.

Army and Navy. The army consists of (1) the *Nizam*, or regular army and reserves, divided into seven corps of infantry, cavalry, engineers, and artillery; (2) the *Redif* (Landwehr), comprising twelve army corps; (3) the *Mustahfiz* (Landsturm), the strength of which can be increased indefinitely. The number of officers and men comprising the *Nizam* probably does not exceed 170,000, but the whole force available in time of war has been estimated at 800,000 or 1,000,000, of which some 600,000 are infantry, and 55,000 or 60,000 mounted troops. All Mussulmans between twenty and forty are liable to service in the field. Little information is forthcoming concerning the state of the navy, which, on the whole, fails to meet the exigencies of modern warfare, though it is now being gradually remodelled. It is supposed to contain between seventy and one hundred steamers (including, it is said, eighteen ironclads) and twenty-five or thirty torpedo-boats. The number of sailors lies somewhere between 12,000 and 30,000.

Education. The educational system, which is closely connected with the Mohammedan religion, was reformed in 1847, and 1,087 free schools for elementary education are now attached to the mosques. Middle schools have also been provided, and the study of medicine, agriculture, and other sciences may be pursued in special colleges.

History. The Ottoman Turks, or Osmanlis, are sprung from the Oguzian Turks, who in the 13th century were expelled from their settlements E. of the Caspian and driven westwards by the advancing hordes of Mongols. As a reward for services rendered to the Seljuk Sultan of Konieh in his struggle with the Mongols and Chorasmiens, a portion of the tribe was allowed to take possession of lands in Phrygia. After extending their dominion in Asia, they crossed the Ægean under Orkhan (1256-59), and seized some of the maritime fortresses of the Eastern Empire. Before the close of the 14th century they had become masters of the larger portion of the empire, the last relics of which disappeared with the capture of Constantinople by Mohammed II. in 1453. The Slavonic provinces in the neighbourhood of the Danube, the northern Adriatic seaboard, the S., E., and part of the N. coasts of the Black Sea, Syria, Rhodes, and Egypt were gradually added to their conquests, which reached their farthest limits under Solymán I. (1520-66). During his reign the Turks experienced serious reverses in Hungary, and their subsequent

history has been one of continuous decline. They finally resigned all claim to Hungary by the Peace of Carlowitz in 1699. In 1736 they encountered a new danger in the aggressive policy of Russia, and after half a century's warfare they were compelled definitely to abandon all the land they had occupied E. of the Dniester (1792). After further hostilities, Russia succeeded in extending her boundary to the Pruth (1812). The Greek struggle for independence (1822-28) was regarded with favour by most of the Continental Powers, and resulted in the formation of Greece into an independent kingdom. It was also mainly through foreign intervention that the Ottoman Empire was saved from the ruin which threatened it in consequence of the ambitious designs of Mehemet Ali, Pasha of Egypt (1833). His rebellion was so far successful that it virtually brought Turkish supremacy in Egypt to an end. In 1853 the Czar found a new pretext for attacking Turkey in his claim to exercise a protectorate over all subjects of the Porte who belonged to the Greek Church. His attempts to enforce his demands brought on the Crimean War, in which Turkey received effectual aid from England, France, and Sardinia. It was brought to a close by the Treaty of Paris (1856), which disallowed the Czar's claims, reinstated the Turks on the banks of the Lower Danube, and excluded all war-vessels from the Black Sea. This latter provision, however, was abolished in the interest of Russia in 1871. Two years later Moldavia and Wallachia were formed into the principality of Roumania. In 1876 Russia again took up arms against Turkey, nominally for the purpose of preventing the maltreatment of the Christian inhabitants of the empire. The Turks offered a courageous and stubborn resistance, but Russia was eventually successful, and in January, 1878, Adrianople was occupied by her troops. The final outcome of the war was the Congress of Berlin, which effected important changes in the limits and administration of the empire. The most important were those which rendered Roumania, Servia, and Montenegro independent states (at the same time enlarging their territory), placed Bosnia and Herzegovina under the protection of Austria, rectified the Greek frontier, and handed over a considerable part of Armenia to Russia. Since 1878 the English have occupied Cyprus (q.v.).

Turkey, any species of *Meleagris*, a genus of game-birds, made the type of a family, *Meleagridæ*, or included in the Pheasant family. Turkeys are the largest of the game-birds, and have the head naked, with a caruncle on the bill, bright wattles on the neck, and a tuft of long hair on the breast; the tail feathers of the male can be erected. The general plumage is brown, with metallic gloss of blue and green. The Common Turkey (*M. gallopavo*), a native of America, owes its name to a misconception. It was introduced into England in the 16th century, and its home was supposed to be Turkey, and the error has been perpetuated in its name. It is the largest of our domestic birds, and is highly valued for the table and for its eggs. The hens, however, often lay away from home, and the

young birds are difficult to rear. The wild stock ranges from the south of Canada to Florida and Texas, but its limits are rapidly being restricted. Southward, another species (*M. mexicana*) is found; and in Yucatan and the Honduras is a smaller form (*M. ocellatus*), with brilliant metallic plumage, and eye-like markings on the tail feathers.

Turkey Buzzard (*Rhinogryphus aura*), a vulture, ranging from the southern states of the Union to the Straits of Magellan. It is about thirty inches long, and in appearance somewhat like a wild turkey.

Turki, the proper national name of the so-called Tatars, who form the western division of the "Mongolo-Tatar" race. [TATAR.] The term *Turk*, as an ethnical designation, is traceable, in its mutilated Chinese form (*Tu-kiu*), back to the 2nd century B.C., when a people of that name dwelt in the Altai region. Here they gradually rose to great power, and in the 1st century of the new era their name had already reached Europe, the *Tureæ* being mentioned both by Pomponius Mela (i. 19) and by Pliny (vi. 7). The Hiung-nu and the On-Uighurs, founders of vast but unstable empires, were all of Turki stock, as were also the bulk of Attila's hordes: "the Huns, whom we commonly call Turks" (G. Theophanes, 8th century). In 569 Sinjibu, Kha-Khan ("Great King") of the Altai Turks, received an embassy from Justin II. of Constantinople, and ever since that time the Turks, under one name or another, have maintained almost uninterrupted relations, hostile or friendly, with the nations of the West, overthrowing the Byzantine Empire (1453) and penetrating up the Danube to the very gates of Vienna (1683). The Turki type, originally Mongolic, had at an early period been profoundly modified by contact with peoples of Finnish race, whence the frequent mention of "red hair," "green eyes," and "white complexion" in the Chinese records. During their later migrations westwards many (Avars, Magyars, Osmanli) became largely assimilated in physique to the Caucasian type, so that at present most of the western Turks are scarcely to be distinguished from the surrounding Iranian and European peoples of Aryan speech; but their Turki language betrays their Mongol descent, while the Mongolic type itself is still conspicuous amongst the Kirghiz, Siberian "Tatars," Uzbeks, most Turkomans, Kashgarians, and Yakuts. In their native steppes the Turki peoples remain essentially nomad pastors (Kirghiz, Turkomans, etc.), but in arable lands they have become excellent agriculturists (the settled Turki communities of Persia and Asia Minor). In religion most remain essentially Shamanists, though all, except the Yakuts and a few other "Orthodox Christians," are nominal Mohammedans, whereas their Mongol kinsfolk are, with few exceptions, nominal Buddhists. The Turki language, a typical member of the Ural-Altaic family (q.v.), is spoken, with some dialectic diversity, throughout a great part of North-East, Central, and Western Asia, in the Balkan Peninsula, the Caucasus, the Volga

basin, and a few other parts of European Russia. Most of the dialects are uncultivated, but those of the historic peoples (Chagatai, Osmanli, Kazan, Krim, and other Russian Tatars) have all been reduced to written form, using the Arabic alphabet, which is ill-adapted for the purpose. The peoples of Turki speech are somewhat thinly distributed over their vast domain of several million square miles, and probably do not number altogether more than about thirty millions. They form three distinct groups, with several subdivisions, as under. (1) **EASTERN GROUP**, comprising the so-called "Tatars" of the Yenesei and Siberia, the Yakuts of the Lower Lena basin, with detached settlements on the Sea of Okhotsk; the Taranchi, Machins, Dungans, and others of Chinese Turkestan (Kashgaria, Kulja, Zungaria); the Yegurs and Daldi of Kansu (North-West China). (2) **CENTRAL GROUP**, comprising the Kirghiz (Kara-Kirghiz or Buruts, Kirghiz-Kazaks, and Kara-Kalpaks), of the West Siberian steppes, the Pamir Uplands, and Lower Volga; the Hor-pa of the Tibetan plateau; the Uzbeks, Kipchaks, Tiuraks, and others of Russian Turkestan, Bokhara, Khiva, and Afghan Turkestan; the Bashkirs, Chuvashes, Meshcheriaks, and other mixed Finno-Turki peoples of Turki speech in the Volga and Ural basins. (3) **WESTERN GROUP**, comprising the Turkomans of Transcaucasia, Persia, and Asia Minor; the Nogai Tatars of the Caucasus, the Crimea, and Kazan; the settled Turki peoples of Azarbaijan (Persia) and Asia Minor; the Osmanli of Turkey in Europe. (Klaproth, Rémusat, Berezine, Vambéry, and especially H. H. Howorth, *The So-called Tartars of Russia and Central Asia*.)

Turkomans (TURKMENIANS), a large division of the Turki race (q.v.), whose domain comprises the whole of Transcaucasia between the Oxus and Caspian Sea east and west, and between the Aral Sea and Irania north and south. Turkoman tribes are also scattered in small groups over Afghan Turkestan, Persia, and Asia Minor. Chief tribal groups: Tekke, Goklan, Yomud, Sarik, Saler, Ali-Eli, Ersari, Chandor, with total population about 600,000, divided into Khalks (tribes), Taife (sub-tribes), and Tiré (clans), and socially into Charwar (nomads) and Churmur (settled). From time immemorial fierce marauders without any political coherence, but since 1881-82 reduced to order under the Russian rule.

Turmeric, the rhizomes of *Curcuma longa*, a perennial herbaceous plant, belonging to the Ginger family, native to Southern Asia. The ovate tubers are the central portion of the first year's growth, and are known as "bulbs:" the long cylindrical "fingers" are lateral growths. Madras turmeric consists of large round pieces; that from Bengal is darker in colour; and that from Java duller. It is always hard and tough, breaks with a resinous fracture, and ranges in colour from orange to brown. It is cultivated in rich, well-watered soil, an acre yielding 2,000 lbs.; but the exports from India have declined from over 8,000 tons, of which England took half, to 1,400 tons, England taking 226. It has long been used as a condiment, and as

a medicine in India, and is an ingredient in curry powder. It is used as an adulterant of mustard; but its employment as a dye has come to an end. It has an aromatic taste due to an essential oil containing the alcohol *turmerol*, $C_{19}H_{23}O$, and its colour is produced by *curcumin*, $C_{14}H_{14}O_4$. This substance, when pure, forms yellow acid crystals, and paper dyed yellow by a tincture of turmeric turns brown on being moistened with an alkali, drying violet. It is, therefore, a common laboratory test for an alkali.

Turn-dun, a small, fish-shaped piece of thin, flat wood, tied to a thong, and whirled in the air to produce a loud roaring noise.

Turner, JOSEPH MALLORD WILLIAM (1775-1851), the great painter, was the son of a barber. It is not certainly known where he was born. He had very little education, but his artistic gifts soon attracted notice, and he was taken up by Reynolds and Girtin. He began very early to exhibit at the Royal Academy, of which he was elected an associate at twenty-four and full member at twenty-eight. He very soon secured a good income, but continued to work hard and to live economically all his life. In 1799 he painted the *Battle of the Nile*, in 1802 his picture of Kilchurn Castle. Up to this time he had travelled much in England. He now began his Continental wanderings, among the fruits of which were *Calais Pier*, *The Vintage at Mâcon*, some Alpine studies, and his Venetian pictures. In 1807 was painted *The Sun Rising in Mist*, in 1813 *The Frosty Morning*, in 1815 *Dido building Carthage*, in 1838 *Phryne as Venus going to the Bath*, in 1839 *The Téméraire*. This marked the highest point of his art. Meanwhile he had also produced *The Rivers of England* (1824), *Ulysses deriding Polyphemus* (1829), and *The Rivers of France* (1833-35), and had illustrated Rogers and Scott. All his life he had lived alone and wandered about in a mysterious manner, and he died in lodgings at Chelsea under an assumed name. By his will he had intended to provide for the foundation of an asylum for distressed artists, but legal difficulties prevented the carrying out of his wishes. Examples of his admirable etching are to be seen in the unfinished *Liber Studiorum*.

Turner, SHARON (1768-1847), historian, was by profession a solicitor. He did some good historical work in the intervals of business, and received a Civil List pension in recognition of it. His best book was his *History of the Anglo-Saxons*, finished in 1805. He also wrote a history of England from the Conquest to the reign of Elizabeth.

Turner, W. (1515-1568), botanist, and dean of Wells, is chiefly celebrated for his "Herbal," which appeared in 1568. He wrote one other book.

Turnicomorphæ, in Huxley's classification, a name for the Bush Quails.

Turning is the art of shaping various materials in the lathe. If a piece of wood or metal is

rotated about an axis, while a cutting tool is held against its surface, portions will be removed until the material is reduced to a circular form. A lathe provides the means for giving this rotary motion to the work. In a modern lathe there is a steel spindle or mandrel, provided with a pulley to which motion is communicated from a fly-wheel driven by a crank and treadle or by steam or other power. This mandrel is fitted in bearings with the greatest nicety, as it is of importance that it shall be able to revolve freely, but be quite unable to move in any other way. The end near the "nose," or screw to which the work is fixed by means of "chucks," runs in a steel collar, and has a conical shoulder to stop end play. In small lathes the other end is supported on a pointed screw, working in hole in the mandrel, while larger machines usually have a second collar, and a flat-ended screw, working upon the end of the mandrel. In either case the end-shake can be adjusted to be as small as possible. The mandrel and its supports—or the "headstock"—is secured to an iron bed, usually consisting of two bars of iron fixed together at the ends, and accurately made flat and straight. A back centre can slide along the bed and be clamped in any position; it has a steel point, adjustable by means of a screw, which can be used to support the end of long pieces of work. A rest, whose top is shaped like the letter T, can also be fixed to the bed in any convenient position. A "chuck" is used to secure the material to the mandrel, and of these there is an endless variety, adapted to various classes of work. The speed of rotation is a matter of importance. For soft wood it can hardly be too rapid, while for metals it must be comparatively slow; and it is, of course, the peripheral speed which is of consequence, so that the speed of the mandrel must depend upon the diameter of the work. In order that the speed may be adjusted, grooves of various diameters are made on the mandrel and driving pulleys, and for heavy work a "back-geared" headstock is used. In this case the pulley runs freely upon the mandrel, and is connected to it by means of a counter-shaft and gear wheels, so that the speed is much reduced.

Turnip (*Brassica rapa*), a biennial crucifer, which occurs in a wild state in England, but has been in cultivation from ancient times, and has been much altered in the process. The hypocotyledonary axis and crown of the root is enlarged into the so-called "bulb," the most important edible portion. Turnips contain 92 per cent. of water and 4 per cent. of pectose, and owe their flavour to a pungent essential oil. They are said to have been cultivated in Flanders in the 15th century, and to have been introduced into England in 1550. In spring the budding shoots are eaten boiled, under the name of *turnip tops*, and are valuable as an antiscorbutic. The coarser but more nutritious *swede*, a variety named from the country of its origin, is only grown as cattle-food with us, forming one of our most valuable winter foods for sheep. There are about two million acres of land under turnips and swedes in the

United Kingdom, yielding from 25 to 30 million tons per annum.

Turnspit, a variety of the domestic dog, with long body, and short, generally bent legs, formerly employed to turn spits by walking round inside a wheel, so causing it to revolve. [DACHSHUND.]

Turnstone, any bird of the northern genus *Streptilas*, of the Plover family, so called from their habit of turning over stones with their bill in search of the crustaceans and molluscs on which they feed. The Common Turnstone (*S. interpres*) breeds in Europe as far south as Denmark, visiting Britain in winter. It is about nine inches long, with black, white, and chestnut plumage.

Turpentine, though originally the name of the oleo-resin of the terebinth (q.v.), which is still known as *Chian turpentine*, is now a general name for the oleo-resins of the Coniferæ. They are yellowish, very viscid, translucent, acid substances, with a strong smell, and burning, bitter, aromatic taste, and consist of various resins dissolved in essential oils which have the formula $C_{10}H_{16}$. By distillation they are separated into *rosin* or *colophony* and *oil*, or *spirit of turpentine* (known in retail trade as "turps"), a colourless oily liquid, soluble in alcohol, ether, and oils, and acting as a solvent for resins and rubbers. It is largely used in the manufacture of varnish, and in painting. When oxidised in the presence of water it gives off hydrogen peroxide, H_2O_2 , a reaction employed in the manufacture of the disinfectant "sanitas." The chief European turpentine is that of *Bordeaux*, obtained by stripping off the bark of the cluster pine, *Pinus maritima* (*P. Pinaster*). In Northern Europe it is obtained from the Northern pine or Scots fir (*P. sylvestris*); in Austria and Corsica from *P. Laricio*. *Venice turpentine*, used in making sealing-wax, and formerly in veterinary medicine, is the product of the larch, *Larix europæa*, and the less abundant *Strassburg turpentine*, of the silver fir, *Abies pectinata*. Turpentine is also obtained from the stone pine, *P. Cembra*, the mountain pine, *P. Pumilio*, and the Aleppo pine, *P. halepensis*. We import from 18,000 to 21,000 tons of oil of turpentine, chiefly from the Southern United States, where it is the produce of the pitch or swamp pine, *P. australis* (*P. palustris*) and the loblolly pine, *P. Tæda*. Canada balsam (q.v.) only differs from other turpentines in being more fragrant.

Turpin, or TILPIN, Archbishop of Rheims in the reign of Charlemagne, was long supposed to be the author of the *De Vitâ Karoli Magni et Rolandi*, descriptive of Charles's conquest of Spain and of the exploits and death of Roland. The work is now variously attributed to Pope Calixtus II. and Aimeri Picaud. It is agreed by all critics that the date of composition cannot have been much before the beginning of the 12th century.

Turpin, DICK (1705–39), smuggler, cattle-lifter, and highwayman, is supposed to have begun life as a butcher's apprentice. He was hanged at

York for the murder of an Epping keeper. It appears that the fame of the great ride to York attributed to Turpin by popular tradition really belongs to a 17th-century gentleman of the road, one Nick Nevison.

Turquoise is a bluish-green mineral, obtained chiefly from Persia, where it occurs in reniform masses. It is hard, and capable of taking a high polish, being hence prized as a gem when of good colour. Chemically it consists of a hydrated phosphate of aluminium, with traces of copper and iron, to which the colour is due, and possesses a composition represented by the formula $\text{Al}_4\text{P}_2\text{O}_{11}5\text{H}_2\text{O}$.

Turrilepas, or PLUMULITES, is a genus of fossils from the Ordovician, Silurian, and Devonian rocks, of much interest as the oldest known Cirripedia (q.v.) or barnacles. The best-known specimens come from the Wenlock Limestone of Dudley and the Silurian rocks of Bohemia.

Turrilites, a genus of Cephalopoda (q.v.) belonging to the group of Ammonoida (q.v.) or Ammonites. It differs from the typical representatives of this group in having the shell in the form of a spiral round a central axis. The genus is extinct, and is found only in the Cretaceous rocks.

Turritellidæ, a family of Gastropoda (q.v.) or univalve mollusca of which several species are common on the English coasts. The shell is a long coiled spire, and the mouth is rounded and unnotched. The family dates from the Trias, but is most characteristic of the Tertiary period.

Turtle. [TORTOISES AND TURTLES.]

Turtle-Dove, any bird of the genus *Turtur* of the family Columbidae, with about thirty species, all from the Old World. The bill is slender, with the upper mandible slightly bent down at the tip; the wings are long and pointed, and the long tail is rounded or graduated. The Common Turtle-Dove (*T. communis*) visits Britain in May, leaving in September. The male is about a foot long, with bluish-grey plumage, and the tail-feathers tipped with white. The name is sometimes given to the Collared Turtle-Dove (*T. risorius*), with pale creamy plumage, and a black semi-circular mark on the nape. [PIGEON.]

Tuscany, a district or "compartimento" of Italy, between $42^{\circ} 20'$ and $44^{\circ} 10'$ N. lat. and $9^{\circ} 12'$ and $12^{\circ} 20'$ E. long.; area 9,291 sq. m. Towards the N. and N.E. the surface is mountainous; elsewhere undulating hills alternate with fertile valleys, and along the sea-coast stretches the malarious Maremma (q.v.). The Grand Duke was deposed in August, 1860, and six months afterwards Tuscany was incorporated in the Italian kingdom. [ETRURIA, FLORENCE, ITALY.]

Tuscaroras, a North American people, originally of North Carolina, who in 1712 migrated northward, and joined the Iroquois Confederacy as the "sixth nation" [IROQUOIS]; reduced (1890) to

733, nearly all in the Tuscarora Reserve, New York, and in Grand River Reserve, Ontario. In the early records of the Carolinas the Tuscaroras are found associated with the historical Pamlico nation, who are now extinct, but whose name survives in Pamlico Sound, Cape Hatteras.

Tusculum, an ancient city of Latium, on the Alban Hills, about 13 miles S.E. of Rome. Under the Mamiliii it became a leading member of the Latin League, but after the battle of Lake Regillus (497 B.C.) the citizens were forced to form an alliance with Rome, to which their descendants remained faithful. In 378 B.C. they received the Roman franchise. Tusculum was a favourite resort of Cicero, who here wrote the *Tusculane Disputationes*. Near its site stands the modern town of Frascati (q.v.).

Tussaud, MADAME (née MARIE GROSHOLTZ), was born in 1760 at Berne. She learnt wax-modelling in Paris, and gave lessons to Madame Elizabeth, sister of Louis XVI. After being imprisoned during the Revolution she set up in London about the year 1802. Here she died in 1850, having laid the foundation of the present exhibition in the Marylebone Road.

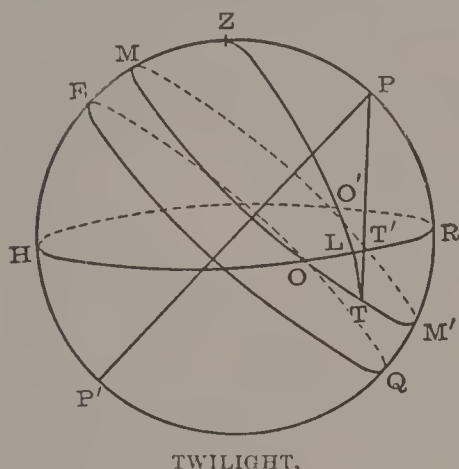
Tusser, THOMAS, was educated at Eton under Udall, and afterwards went to Cambridge. He became successively courtier, Suffolk farmer, lay clerk in Norwich cathedral, again a farmer, and ultimately settled in London, where he died about 1580. While living at Cattiwade, Suffolk, he wrote his *Five Hundred Points of Good Husbandry* (1557), of which there are three modern editions.

Tussock-Grass (*Dactylis cespitosa*), a grass native to the Falkland Isles, where it grows in large hummocks, cattle being very fond of its sweet nutty stalks. It has been successfully established in the Hebrides.

Tweed, a river of Scotland, which flows in a N.E. direction through Southern and Central Peeblesshire, then, turning E., traverses the N. portion of Selkirkshire and Roxburghshire, and, finally, resuming its N.E. course, for 18 miles forms the boundary between Berwickshire and Northumberland, thus separating the sister-kingdoms. Its length in all is 97 miles. The salmon-fisheries attract anglers, but the river has larger claims on all lovers of beautiful scenery. It also figures largely in the legendary lore and ballad literature of the border, and its name is inseparably associated with that of Sir Walter Scott.

Twilight is a lengthening out of the day after the sun has sunk below the horizon, or before he rises above it, and is caused by the reflection of light by the atmosphere. It is the same sort of thing as occurs in mountainous districts, where the peaks reflect light into the valleys below when the sun is below the horizon as seen from the valley. It has been found that twilight will be enjoyed at every place till the sun has sunk 18° below the horizon; if the sun is moving vertically, therefore,

he will soon traverse that distance, and the twilight will be of short duration. If, however, he is travelling in a plane cutting the horizon at a much smaller angle, he will take longer to get 18° below it, for he will have to travel farther in his own path, and consequently twilight will last longer. Let $HZPR$ represent the meridian of a place in the northern hemisphere. The circle $HOR O'$ at right angles to the meridian will represent the horizon, and Z will be zenith. If PP' be the axis of the earth, ZP will be 90° minus the latitude of the place, for if EQ be the equator EZ is the latitude. Now, the sun's daily path is in a circle parallel to the equator. During the summer months the circle will be north of the equator, so let MM' represent it, the points $o o'$ being the points of intersection of horizon and solar path. Draw an arc, ZT , cutting the horizon at L , such that LT is 18° ; then, since ZL is, of course, 90° , ZT is 108° . Twilight then lasts while the sun is moving from T to O ; from O to O'



the sun is above the horizon, so it is day; from O' to a point T' (corresponding to T) it is evening twilight; and from T' to T it is night. We know the sun's polar distance, PT , as we know what days of the year we are considering; ZP is the 90° latitude, and

ZT is 108° , so we can calculate the angle ZPT by spherical trigonometry. This gives us the time at which twilight will begin; so, knowing the time of sunrise, we can subtract the one from the other and find the duration of twilight. If ZM' were 108° , then absolute night would not exist, for twilight would last the whole time from sunset to sunrise. This is the case in the latitude of London during a few nights in June on either side of the longest day. In latitude $48^\circ 30'$ there is one night—June 21st—when only twilight exists. In this case the sun has reached his most northern limit, so $M'Q = 20^\circ 30'$, $PR = 48^\circ 30'$, and since $PQ = 90^\circ$ it follows that $RM' = 90^\circ$ minus $(23^\circ 30' + 48^\circ 30')$. Hence $RM' = 18^\circ$, which is just the limit of twilight. Below latitude $48^\circ 30'$ there can be no such vanishing night, but in higher latitudes the number of such nights increases, until we get to the point when twilight, too, ceases, and the sun itself actually shines all night. The length of this continuous day increases as we approach the pole, but is balanced by the continuous night of the winter months. In the tropics the sun rapidly sinks below the horizon, and twilight lasts only about an hour.

Twining, THOMAS (1734-1804), rector of White Notley, Essex, and afterwards of St. Mary's, Colchester, published in 1789 a good translation of Aristotle's *Poetics*. A successful publication of 1883, *Recreations and Studies of a Country*

Clergyman of the Eighteenth Century, was made up of selections from his correspondence.

Twiss, SIR TRAVERS, jurist, was born in 1809. He was educated at University College, Oxford, of which he became fellow and tutor. He was professor of political economy from 1842 to 1847, and of civil law from 1855 to 1870, at Oxford, and held the chair of international law at King's College, London, from 1852 to 1855. In 1867, when he was knighted, he became Queen's Advocate-General. In 1884 he drew up the constitution of the Congo Free State. He also published valuable works dealing with international law, and *Monumenta Juridica: The Black Book of the Admiralty* (1871-76).

Tyler, JOHN (1790-1862), tenth President of the United States of America, was born in Charles City County, Virginia. In 1809 he was called to the bar. From 1811 to 1816 he sat in the Virginian Legislature, and in 1817 was elected to Congress. In 1825 he became Governor of Virginia, and in the next year a United States senator. He pursued a very independent course both in Congress and in the Senate, and was generally in favour of compromises. In 1836 he had differences with his constituents on the Bank Question. In 1840, however, he became Vice-President of the United States, and less than a year later President on the death of Harrison. He vetoed two bills for the re-establishment of the United States Bank, and also two Protective bills. During his term of office the Ashburton Treaty was made and Texas annexed. In 1861 he endeavoured to mediate between Federals and Confederates, but finally joined the latter.

Tyler, WAT, one of five Tylers who took part in the peasant rising in 1381. Wat of Dartford liberated John Ball from Maidstone Gaol, and headed a body of peasants, who on June 13 marched into London, killed lawyers and Flemings, destroyed John of Gaunt's Savoy Palace, and took possession of the Tower. Wat was struck down by Sir William Walworth while parleying with the king at Smithfield two days later.

Tylor, EDWARD BURNETT, was born in 1832. In 1856 he went with Henry Christy on a scientific tour in Mexico, and in 1861 published *Anahuac, or Mexico and the Mexicans*. It was followed by *Researches into the Early History of Mankind* (1865) and *Primitive Culture* (1871), which placed the author in the first rank of anthropologists. In 1871 he was elected F.R.S., and in 1883 became Reader in anthropology at Oxford and keeper of the University Museum. In 1891 he was President of the Anthropological Society.

Tympanum. [EAR.]

Tyndale, or TYNDALL, WILLIAM (1484-1536), translator of the Bible, was born in Gloucestershire, and studied first at Oxford and afterwards at Cambridge. In 1523 he came to London, but next year left it for Hamburg. Two years later, while at Cologne, he begun the printing of his English New Testament. The work was interrupted, but a new

edition was executed at Worms, which in 1526 found its way to England. By 1530 six editions had been printed, but they were seized by the Church authorities, and copies are now exceedingly rare. In the same year an English version of the Pentateuch was printed at Marburg. At Antwerp, where Tyndale spent his last two years in hiding, part of the Old Testament and Apocrypha appeared in English in 1534, and in the next year a revision of the New Testament. In 1535 Tyndale was treacherously seized and burnt by order of the Emperor, who had made a treaty with Henry VIII. for the suppression of Lutheran books. According to tradition, he translated the Old Testament as far as the Book of Chronicles while in prison. This portion was printed with the Pentateuch and New Testament in Matthew's Bible. Tyndale's translation forms the basis of the Authorised Version. He also wrote *Obedience of a Christian Man* (1528), and engaged in controversy with Sir Thomas More.

Tyndall, JOHN (1820-94), the physicist, was born at Leighlin Bridge, in Ireland. After having been an engineer at Manchester, he began his original work while a teacher at Queenwood College in Hampshire. He studied at Marburg and Berlin, and in 1853 was made professor to the Royal Institution. Three years later he went with Huxley to the Alps and collaborated with him in a work on glaciers. In 1874 his address as President of the British Association roused the indignation of theologians. He afterwards became scientific adviser to the Board of Trade. His death resulted from accidental poisoning during an illness in 1894. His chief works were *Heat as a Mode of Motion* (1863) and *Fragments of Science* (1876 and 1892); and he was very successful as a lecturer both in England and America.

Tyne, a river of Northern England, formed by the junction of the North Tyne and the South Tyne, one mile north-west of Hexham. From that point it has a course of thirty miles to the sea, for the last eighteen of which it separates Northumberland from Durham, its direction throughout being east. Its waters from Newcastle to Tynemouth (a distance of ten miles) form a single continuous harbour.

Tynemouth, a parliamentary and municipal borough and watering-place of Northumberland, situated on the north side of the mouth of the Tyne, opposite South Shields, and eight miles east by north of Newcastle. The watering-place lies east of North Shields (q.v.), which is included in the borough, and has a fine sandy beach, nearly a mile in length, which makes it a favourite resort for bathing. The pier, which is more than half a mile long, was completed in 1892. Within the castle precincts are the remains of the priory of SS. Mary and Oswin, consisting chiefly of a church of Norman and Early English date.

Type (Greek τύπος = "a stamp") denotes the small pieces of metal which are arranged in "forms" to impress letters upon paper and other substances, the end which is presented to the paper having the letter cut or cast upon it in reverse. A

fount of type comprises 227 characters; and besides the simple letters of various kinds there are combinations known as "ligatures" and "logotypes." Types are also classified as "shorts," "ascenders" (where a part rises above the general level of the line), and "descenders" (where a part extends below this level). In setting-up type, the spaces between words and lines are preserved by the insertion of small blocks and strips of metal. The width of type differs considerably, and the size of letters is divided generally into the following nine classes:—English, Pica, Small Pica, Long Primer, Bourgeois, Brevier, Minion, Nonpareil, and Pearl; and there are other sizes. The metals used by type-founders are tin, antimony, copper, and lead, but most founders have their particular secrets. Antimony and copper have a tendency to harden the type and to give it a sharp outline, while tin imparts durability. The earliest material for making type was wood. The chief processes of founding are cutting the punch which forms the letter, sinking the matrix, mixing the metals, casting the type, finishing and dressing it. Casting-machines and other inventions have much lessened the labour of founding. The earlier kinds of type were the German character (still in use in the majority of German books), the Roman (adopted in 1470), and the Italic or sloping type (1501). The Aldine editions are printed in this type, but it is now chiefly used for emphasising or drawing special attention to words. Caxton employed Flemish type, and English printers generally went to one or other foreign country for their type. But in the middle of the sixteenth century an English foundry was started. Although in Tudor times Roman type was used for devotional books, yet black letter was slow to go out of fashion. It had, however, passed away before the dawn of the seventeenth century. Elzevir, Baskerville, and Didot type were characterised by their roundness and clearness.

Type-founding. [TYPE.]

Type-Metal consists of an alloy of 2 parts lead, 1 part tin, and one part antimony. It is readily fusible, and expands slightly on solidification; so that it is well adapted for casting and copying moulds; while it is hard enough to withstand the wear of the printing.

Typewriter. [WRITING MACHINE.]

Typhlitis, inflammation of the cæcum, with pains in the right iliac fossa, and constipation.

Typhlosole, a ridge running down the interior of the intestine in many worms and Ascidians, and in some fish (such as the Cyclostomes), whereby the area of the wall of the intestine is increased.

Typhoid Fever (ENTERIC FEVER), a malady characterised by a condition of inflammation affecting the lymphoid glands of the intestines, and accompanied by a state of continuous fever, and usually by the development of a characteristic rash. The disease is widely distributed throughout the globe, and has probably prevailed from early

times, but it is only within recent years that it has been distinguished from typhus fever, the distinction between these two maladies being finally established by Sir William Jenner about the middle of the present century. The incubation period of enteric fever is of somewhat variable duration, but usually covers about a fortnight. The early symptoms are rise of temperature, headache, vomiting, and diarrhœa, with pain and tenderness on the right side and lower part of the abdomen. The tongue becomes coated with fur, and tends to get dry; and there may be delirium, especially at night-time. At the beginning of the second week from the commencement of symptoms the rash appears; it consists of slightly elevated rose-coloured spots which disappear on pressure, and which are mainly developed on the abdomen, chest, and back. These spots come out in successive crops, each of which lasts for a few days; in some instances the rash is very scanty, and it may be altogether absent. As the disease progresses the abdomen becomes swollen, and pain and tenderness in the right lower abdomen are more marked, the edge of the spleen can usually be felt just beneath the ribs on the left side, diarrhœa is generally present, and the stools tend to assume what is known as the pea-soup character. In some instances recovery now gradually ensues; in others what is known as the typhoid condition becomes developed, the fever remaining high, the pulse rapid and feeble, and a condition of prostration accompanied with drowsiness and delirium supervening. The lips are now often covered with sordes, and blood sometimes appears in the stools. Recovery may still take place, but in the more severe cases the patient passes into a condition of coma and dies. Even in favourable instances recovery from the disease is a tedious process, and relapses are liable to occur. In most attacks of enteric fever the lungs are to some extent affected by bronchitis; sometimes this condition severely aggravates the malady, and actual pneumonia may be developed. Bleeding from the bowel is a symptom which is not infrequent during the third and fourth weeks of the disease; it is commonly associated with the process of ulceration which is in progress in the intestine, and the loss of blood may in some cases be so great as to cause death. When the wall of the intestine becomes completely eaten through by ulceration, perforation is said to occur, and peritonitis results. This complication is almost invariably fatal, and is usually made evident by the sudden onset of intense pain in the abdomen, with vomiting and collapse. Numerous sequelæ of the disease have been observed: bed-sores are apt to form, thrombosis of the veins may be developed, and ulceration of the larynx sometimes occurs. The mortality among persons attacked is usually about 15 or 16 per cent.

The condition of the intestines in typhoid fever is the most characteristic lesion in that malady. The masses of lymphoid tissue in the lower part of the small intestine are particularly involved. The solitary glands and the agminated glands (Peyer's patches) become swollen and then (usually after the lapse of nine or ten days) commence to

undergo ulceration. Sloughs are formed, and these sloughs become separated, usually during the third week of the illness; after this the ulcer, in the absence of an unfavourable issue, gradually heals. In association with the intestinal mischief the lymphatic glands of the mesentery become enlarged, and the spleen is almost always considerably swollen and congested.

The treatment of the malady consists in enforcing absolute rest in bed and administering a suitable diet, from which all forms of solid food must be carefully excluded. In severe cases stimulants are generally necessary, and drugs are sometimes administered with the special object of reducing the fever. Lung complications, hæmorrhage, etc., require, of course, the adoption of special measures. Perhaps in no disease is the patient more dependent upon skilled nursing than in typhoid fever. The disease usually occurs in children and young adults, and is rare at later ages. It is especially prevalent in the autumn, and is least common in spring. Dr. William Budd first directed attention to the fact that cases of the disease were traceable to the consumption of polluted water, and this mode of origin of enteric fever has been abundantly confirmed by subsequent researches. Typhoid fever has also been caused by contaminated milk and cream. In some instances it has been attributed to the effluvia from drains and sewers to which typhoid stools have obtained access. The disease does not appear to be conveyed from person to person, as is the case with scarlet-fever and small-pox, and those who are brought in contact with typhoid fever patients incur little risk of contracting the malady provided they adopt ordinary precautions as to cleanliness.

The numerous outbreaks of the disease which have been traced in recent years to the contamination of public water-supplies, and the great reduction of typhoid mortality in this country which has followed upon the adoption of improvements designed to prevent faecal contamination of drinking-water, sufficiently indicate the most important source of the disease, and the direction in which the safety of the individual can be further assured. A particular organism to which attention was first directed in 1880 by Eberth, and which has been since attentively studied by Gaffky and others, is almost invariably met with in the spleen, Peyer's glands, and mesenteric glands of typhoid patients, and is usually considered to be the cause of typhoid fever.

Typhus Fever, an infectious malady, the chief symptoms of which are fever and a characteristic eruption, which appears about the fifth day from the commencement of the illness. The period of incubation varies between five or six days and a fortnight. The disease is ushered in with the ordinary symptoms of fever, the attack being often quite sudden; the temperature is considerably elevated from the first, and attains its maximum at the end of five or six days. It remains high for a few days, and subsides by crisis about the thirteenth or fourteenth day in cases which recover. The rash consists of what is called a subcutaneous

mottling and of dusky red spots, and presents some resemblance to the eruption of measles. It is developed usually on the fourth or fifth day, and the severity of the disease bears generally some relation to the abundance of the rash. The nervous symptoms of typhus fever are usually prominent. There is at first headache, then some tendency to delirium, and at the end of the first week the patient is markedly delirious. In fatal cases death is ushered in by coma, and sometimes by convulsions. The mortality is about 15 per cent., and is not very different from that of typhoid fever, though it should be noted that the prospect of recovery in typhus is very much less in the case of old than of young patients, a contrast which does not hold good in typhoid. The disease, which is now of rare occurrence in this country, was at one time widely prevalent. Epidemics occurred from time to time, particularly in association with overcrowding and distress, such as were met with in the unhealthy areas of towns, in prisons, and in camps. It has been especially fatal in Ireland. In recent years in this country its effects have only been manifested by the occurrence of small groups of cases in large centres of population, particularly in certain seaport towns.

Tyrconnell, RICHARD TALBOT, EARL OF, an Irish adventurer, who, after many discreditable Court intrigues, gained the favour of James II., and was made commander-in-chief in Ireland. He next became Lord-Lieutenant, and in that capacity did his best to assist the king in his Catholic schemes. In 1689 he raised Ireland for his exiled master, commanded his infantry at the Boyne, and after the first siege of Limerick followed him to France. He returned, however, in the next year (1691), and died in Ireland.

Tyre, an ancient city of Phœnicia, situated on the E. coast of the Great Sea or Mediterranean, in 33° 12' N. lat., on the same site as the small modern town of Sûr. Besides this island-city (now connected with the mainland by an isthmus which arose through the accumulation of sand on either side of Alexander's Causeway) there was a large town called Palætyrus, on the neighbouring shore. The island-city is mentioned in an Egyptian papyrus as far back as the 14th century B.C., and the Old Testament abounds in allusions to its commercial activity. Tyre was occupied by the Crusaders from 1124 to 1291. After their departure it fell into the hands of the Moslems, who reduced it to a heap of ruins. The present town has been built since 1766, when the Metawileh arrived in the neighbourhood.

Tyrol, a province of Austria, bounded on the N. by Bavaria, E. by Salzburg and Carinthia. W. by Switzerland, and S. by Italy; area (with Vorarlberg) 11,307 square miles. The surface is mountainous, being traversed from E. to W. by the main chain of the Alps, and includes the basins of the Inn and the Lech on the N., and the Etsch (Adige) and the Drave on the S. The occupations of the people are mainly pastoral, but forestry and the cultivation of maize, wheat, and other cereals are also

important industries; and in the southern valleys wine and fruit are grown, and silkworms reared. About three-fifths of the inhabitants are Germans, the remainder being Italians; they are nearly all Roman Catholics. The Tyrolese are noted for their loyalty to the House of Hapsburg, of whose hereditary dominions their country has formed a part since the 14th century. The government is carried on by a Diet and Landtag, which meets at the capital, Innsbruck (q.v.).

Tyrone, an Irish county in the province of Ulster, bounded by Donegal and Fermanagh on the N.W., W., and S.W., and by Londonderry, Lough Neagh, Armagh, and Monaghan on the N.E., E., and S.E. It is 48 miles long, with a mean breadth of 28 miles, and has an area of 1,260 square miles. The surface is mostly hilly, rising to a height of 2,236 feet on the N.E. border, and sinking into a plain in the neighbourhood of Lough Neagh. The soil of the lower portions is fertile and well cultivated. There is a coalfield in the E., and marble is quarried near the Monaghan border. Linen and woollen goods, earthenware, whisky, and soap are manufactured. Omagh is the county-town.

Tyrone, HUGH O'NEILL, EARL OF, called "the arch-rebel," was in 1587 given the earldom and lands of the house of which he was an illegitimate member, in return for his services against Desmond. He soon, however, began to intrigue with Spain, and in 1587, calling himself "The O'Neil," headed a rising against the English. In the next year he defeated their commander, Bagenol, who was his wife's father, and the whole of Ireland rose. When Essex arrived with an army, however, O'Neill submitted; but in 1601 he joined the Spanish invaders, and was defeated and wounded. On his submission he was again reinstated in his earldom; but under James I. once more intrigued with Spain. In 1607 he fled to Rome, where he died in 1616.

Tyrosine, $C_9H_{11}NO_3$, may be prepared synthetically by reactions which prove its constitution. It forms fine silky needles, colourless, tasteless, and odourless, insoluble in ether, and almost so in alcohol, but soluble in boiling water. It may be obtained from almost all animal substances by fusion with alkalis, and is found in many of the tissues of the human body, *e.g.* liver, spleen, pancreas.

Tyrtæus, the Spartan poet, is said to have been an Athenian by birth. He was a lyric poet of some talent, but it was the war-songs which inspired the Spartans in their Messenian wars which made his name famous. A few of these have been preserved. He was probably still alive in 668 B.C.

Tyrwhitt, THOMAS (1730-86), son of a London clergyman, was educated at Eton and Oxford, and was from 1762 to 1768 clerk of the House of Commons. After his retirement he edited Chaucer's *Canterbury Tales* (1775). He also took part in the exposure of Chatterton's forgeries, and was the author of *Conjectures* on various Greek authors.

Tytler, a family of Scotch historians. (1) WILLIAM TYTLER, of Woodhouselee (1711-92), published in 1759 an attempted vindication of Mary Stuart, and edited in 1783 *The Poetical Remains of James I. of Scotland*. (2) ALEXANDER FRASER, his eldest son (1747-1813), practised at the Scottish bar, and in 1802 became Lord Woodhouselee and a judge of the Court of Session. In 1780 he was made professor of history at Edinburgh, and in 1801 published the popular *Elements of General History*. He also wrote a life of Lord Kames. (3) PATRICK FRASER TYTLER (1791-1849), fourth son of Lord Woodhouselee, followed his father's profession. Besides several biographical works, he wrote a good *History of Scotland* in nine volumes, and *The Progress of Discovery on the Northern Coasts of America*, in recognition of which he received in 1844 a Civil List pension.

U.

U, the 21st letter of our alphabet, is said, together with v, w, y, to come from the ancient letter Vau (F). U and V in later times became interchangeable, but V was sometimes retained as an initial letter, and U as a medial. The Anglo-Saxon *u* sound is still partially preserved in such words as *butcher*, *full*, etc., and particularly in the North Country, as also in German and some of the Romance languages, and in many English words now spelt with *oo*. The French *u* and German *ü* are alike in sound, and the same sound of the letter is to be found in Welsh and in the West Country.

Ucayali, a river of South America, rising in the Peruvian Andes as the Apurimac, and flowing N. for about 1,000 miles, during which course it receives the Umbamba, Tapichi, Mentaro, and other tributaries. It joins the Amazons in lat. 4° 40' S., long. 73° 80' W., and is navigable for large vessels as far as Sarayacu.

Udall, NICHOLAS (1505?-1556), earliest English comedy-writer, was born in Hampshire. He studied and graduated at Oxford, was ordained, and became head-master of Eton, and subsequently of Westminster School. His chief claim to renown is that he wrote about 1553 *Ralph Roister-Doister*, the earliest of English comedies. It is in rhyme, and only one printed copy of the original edition is known, but there are modern reprints.

Uganda, a territory of Central East Africa, on the N. shore of the Victoria Nyanza, and extending as far as the Albert Nyanza to the W. In 1877, under the auspices of King M'Tesa, Anglican and Catholic missionaries settled there, but on his death in 1884, M'Wanga, his successor, under the influence of Arab slave-dealers, began persecutions. The king was deposed by his brother, Kawewa, but ultimately returned and embraced Romanism. Meanwhile, in 1888 the Imperial British East Africa Company had acquired from the Sultan of

Zanzibar and other chiefs nearly all the district between Uganda and the East Coast. The civil war raging beyond their border led to the interference of the Company's officials, and by a treaty with Germany in 1890 the country was brought within the sphere of British influence. Under Captains Lugard and Williams some sort of order was restored between the contending factions, and Sir Gerald Portal was sent out as Imperial Commissioner pending the decision of the Government as to the definite annexation.

Ugolino, COUNT, Tyrant of Pisa, immortalised by Dante in his *Inferno*, was born in the 13th century of an illustrious Neapolitan family, named Gherardesca. He was appointed chief magistrate of Pisa, and attempted to form a principality, as Visconti had done at Milan and Della Scala at Verona. In 1274 he was imprisoned by the Pisan Government for his intrigues, but was recalled in order to assist in defending Pisa, then harassed by enemies. By treachery and bribery he managed to secure the control of the government, and ruled his subjects ruthlessly. Roger de Ubaldini, Archbishop of Pisa, with whom he had made a pact, which he failed to keep, conspired against him, and, being as unscrupulous as himself, caused his arrest in 1288, and had him starved to death.

Uhland, JOHANN LUDWIG (1787-1862), famous German poet, was born at Tübingen, and in 1810 went to Paris to study law, but gave most of his time to the examination of old German manuscripts. He settled in Stuttgart as a lawyer on his return, and then published his first volume of poems in 1815. These *Gedichte* have nearly reached their 70th edition. In 1829 he became professor of German at Tübingen. He published various dramas, critical essays, etc., but his *Gedichte*, which were frequently revised and added to, have made his name a household word throughout the German states. Some of his poems are very beautiful, and have often been translated.

Uigurs, a historical Turki people, who towards the close of the 10th century rose to great power under their Khan, Satuk Boghra. Bishbalik, the present Urumtsi, was the chief seat of their empire, which stretched from the frontiers of China to the Caspian Sea. Before the introduction of Islam under Satuk Boghra the Uigurs had been converted in large numbers to Christianity by missionaries from Syria, who first arrived in the 7th century, and reduced the Uiguric language to written form with an alphabet based on the Syriac. This script was afterwards adopted by the Mongolians and Manchus, amongst whom it is still in use. The Uigurs, who are the Hoei-Hoei and Kas-che of the Chinese records, are extinct as a separate nationality; but, having taken part in the first Mongol invasion of Europe, their name still survives in the "ogres" of fable and the nursery. The Chentu people of the Turfan district, south-east of Urumtsi, claim to be descendants of the Uigurs, and in 1890 the Russian explorer, Grun-Grijimailo, discovered in their territory many remains of the former Uigur culture.

Uist, two islands of the Outer Hebrides, Inverness-shire, Scotland. North Uist lies $2\frac{1}{2}$ miles N. of Benbecula, and 8 miles S.W. of Harris, and is of irregular shape, being 17 miles long, by 8 miles to 3 miles broad, with an area of 118 square miles. To the E. its surface is marshy and barren, broken by several lakes, but to the W. it rises to the height of Ben Croghan, 1,500 feet, and here occur several valleys, where oats, barley, and potatoes are grown. Fishing and sheep-breeding, with the gathering of sea-weed, are the chief industries. South Uist lies one mile S. of Benbecula, and resembles the other island in all respects, except that its highest point, Mount Hecla, attains nearly 3,000 feet. Its area is 127 square miles.

Ukraine (Polish "Frontier") is the name formerly given to a province extending over part of Russia and S.E. Poland, and now divided into the governments of Kiev, Poltava, and Kharkov. Ceded by Poland to the Cossacks in 1672, and acquired by Russia in 1682, it was subsequently shared between Russia and Poland, the Dnieper separating the two countries. In 1795 Russia annexed the whole. Kiev was the capital.

Ulcer, a sore resulting from the destruction of a portion of the skin, or of the mucous membrane, as the result of injury, inflammation, or new growth. While an ulcer thus affects the cutaneous or mucous surfaces, the mischief may originate in deeper parts, and spread outwards, so as to involve the overlying skin or mucous membrane. There are certain predisposing causes of ulceration which demand consideration; any impairment of general nutrition, such as is present in scurvy, gout, etc., may exert such an influence, and interferences with the activity of the general circulation, or local obstructions to the flow of blood through the affected part, have considerable effect in this connection. Several varieties of ulcers are described, among which may be mentioned the healing ulcer, the chronic ulcer, the sloughing ulcer, the syphilitic ulcer, the strumous ulcer, the scorbutic ulcer, the rodent ulcer, and the epitheliomatous ulcer. The treatment of ulcers is essentially bound up with their cause, and must necessarily be carried out under skilled advice.

Ulema (THE LEARNED), a class of theologians and expounders of Mohammedan law, to be found in most great Mohammedan cities of the East, notably at Constantinople, Mecca, and Cairo. So far as Turkey is concerned, the Sheik-el-Islam is at their head, and they are divided into (1) Mollahs, (2) Muftis, (3) Imaums, (4) Softas, or students. Their decrees are called "fetvas," and they have great influence upon Mohammedan life, chiefly of a conservative nature.

Ullswater, or ULLESWATER, next in size after Windermere of the English lakes, is situated between the counties of Cumberland and Westmoreland, 5 miles S.W. of Penrith, having the mountain mass of Helvellyn on its S.W. shore. Its length is eight miles, and its average breadth one mile, the depth being about 210 feet.

Ulm, a city of Württemberg, situated on the left bank of the Danube, about 46 miles S.E. of Stuttgart. The river being navigable from this point, Ulm has long been a place of commercial and military importance, and was one of the Imperial free cities. The cathedral is the finest specimen of 14th-century Gothic in Germany after the famous Dom of Cologne. Here in 1805 Mack surrendered to the French under Ney.

Ulphilas (311-381 A.D.), Gothic Bishop, became a Greek Christian after being sent to Constantinople, probably as a hostage, and seems to have taken some kind of orders. He studied the Scriptures deeply, and translated them into Gothic, and was in 341 made Bishop of the Goths by Eusebius of Nicomedia. Only a small portion of his translation has been preserved, and it is of great philological value.

Ulster, the most northerly province of Ireland, embraces the counties of Antrim, Armagh, Cavan, Donegal, Down, Fermanagh, Londonderry, Monaghan, and Tyrone, having an area of 8,560 square miles. Settled by the English in 1611, and largely colonised by the Scotch, it is the most commercially prosperous and most Protestant quarter of the island, though the Catholics largely preponderate. Ulster tenant right, by which outgoing occupiers received compensation from their successors, was the basis for legislation in the Irish Land Act of 1870.

Ultramarine. The well-known pigment of this name was formerly entirely obtained from the naturally-occurring mineral *lapis-lazuli*, and was then much prized and very costly. The observation, however, of blue masses in the furnaces used for the preparation of soda led to an artificial preparation of the compound, which was first effected by Gmelin in 1828. It is now manufactured by heating a mixture of clay, glauber salt, white sand, sulphur, and resin, in crucibles placed in suitably-arranged furnaces. The exact constitution of ultramarine is unknown, and analyses of different samples vary. They all contain, as essential constituents, silica, alumina, soda, and sulphur, and may perhaps be regarded as a variable thiosilicate of alumina and soda. The varieties are usually more stable the more silica there is present. The pigment is very largely employed for the manufacture of water- and oil-colours, for paper-staining, and also in calico printing.

Ultramontane, a term used in contradistinction to Gallican, to signify the doctrine that Papal utterances *ex cathedra* on matters of faith and morals are irreformable.

Ulugh-Beg (1394-1449), a Tartar prince and astronomer, was the grandson of Tamerlane, and his real name was MOHAMMED TARAGAI. Devoted to scientific pursuits, he acquired great knowledge of astronomy and geography, and founded institutions to spread such knowledge. He was regent during his father's life and for many years after, and was put to death by his son, who had revolted. He wrote some valuable observations on the fixed stars, and also works on geography and chronology.

Ulysses (the Latin form of the Greek ODYSSEUS) was the name of a Greek hero, king of the Isle of Ithaca, who fought with great prowess at the siege of Troy. His adventures after leaving Troy are related in Homer's immortal *Odyssey*. The lotus-eating of the Lotophagi, the killing of Polyphemus, the enchantment by Circe, the wreck off the Isle of Ogygia, and the final return to his faithful wife Penelope, are all described.

Umbel, a kind of inflorescence in which the pedicels all proceed from a single point, and are of equal length or corymbose.

Umbelliferæ, a natural order of calycifloral dicotyledons, comprising about 1,500 species in nearly 300 genera, for the most part northern and extra-tropical. They are mostly herbaceous, though in many cases perennial, and sometimes of considerable size. The stems are usually fistular, and the leaves scattered, exstipulate, pinnately compound or decomposed, and furnished with a well-developed sheath. The inflorescence is generally a compound umbel of small flowers, most commonly white and protandrous. The calyx consists of five superior sepals; the corolla, of five epigynous petals with inflexed points: there are five stamens, and two coherent carpels with separate styles, and an epigynous disk. Each carpel contains one pendulous anatropous ovule, which forms an albuminous seed. The fruit is a *cremocarp*, generally dehiscing into two *mericarps*, which are often, as in the case of the caraway (q.v.), mistaken for seeds. They remain suspended to a *carpopore*, often Y-shaped, and are marked externally with five or nine ribs, between which lie large *vittæ*, or sacs, containing essential oil. Many of the plants of the order are esculent, their volatile oils giving agreeable flavours to the roots of angelica, carrot, and parsnip, the foliage of parsley and fennel, and the carminative fruits of celery, caraway, anise, and coriander. Others contain fetid gum-resins, and others acrid poisonous sap, such as the hemlocks. There are about fifty-five British species in no less than thirty-five genera.

Umber, a pigment which consists of a clay coloured by oxides of iron and manganese. The raw material is "burnt," by which means water is expelled, and the pigment takes a redder colour. It is then powdered, and may be used for the preparation of either water-colours or oil-colours. The best varieties are obtained chiefly from Cyprus, and from their colour and permanence are valuable pigments.

Umbilical Cord, the structure which serves to convey the blood circulating in the system of the fœtus to and from the maternal placenta. It contains two arteries, which carry venous blood to the placenta, and a single vein, which conveys blood from that organ to the fœtus.

Umbrella, originally a sun-shade, but in northern climates transformed into a protection against rain. It was a symbol of royalty and authority, and as such was used in Egypt, Nineveh, Persepolis, etc., and is so used by some African

potentates of the present day. It was used by women in Greece and Rome; and in Spain, France, and perhaps England, was so used by women in the 16th century; but the first man to use it in England as a protection against rain is said to have been Jonas Hanway in the 18th century.

Umbria, a province of ancient Italy, situated between Cispadane Gaul on the N. and the Sabine territory on the S., derives its name from a Celtic tribe, Umbri, who became subject to Rome, after a severe struggle, in 280 B.C. Their country, though divided in later times between Spoleto and Urbino, retained its geographical designation, and even since its incorporation in 1860 with the kingdom of Italy was preserved as an administrative division. It is drained by the Tiber and Velino, contains the Lake Trasimeno, and is rich in agricultural produce.

Unconformability, an interruption of the sequence of stratified rocks, in consequence of which the various parts of the undersurface of an overlying stratum do not rest upon corresponding parts of the underlying stratum. In cases of *extreme* or *marked* unconformability it is accompanied by a change in dip, as where, in various parts of England, horizontal Triassic rocks rest upon curved Carboniferous ones. This generally implies a considerable break in time, during which the lower strata have been tilted or folded, planed down by denudation, and redepressed, so as to be covered by the more modern deposits. In other cases, however, there may be no discordance in dip, as where horizontal Thanet Sands rest upon the eroded surface of equally horizontal Chalk. This may mark a lesser break in time.

Undine, a species of female water-sprite, possessing a human body, and capable upon marriage with man of receiving a soul. La Motte Fouqué, in his exquisite story *Undine*, gives us an example of such a wayward spirit, who was brought up by a fisherman and his wife, and who greatly perplexed them by her vagaries till her marriage with a wandering knight humanised her. Her husband eventually lost her through his unfaithfulness, and she returned to her native element.

Undulatory Theory. Newton accounted for the effect of light by supposing that any source of light threw off tiny material particles in every direction, and that these, hitting against the retina, produced the sensation of light, *i.e.* caused us to see the luminous body. This hypothesis was known as the Corpuscular Theory, and held ground for some time; but it was shown that a result of this theory would be that light would travel faster in very refractive substances than in less refractive ones; it would, for example, have a greater velocity in water than in air. Now experiment proves this to be untrue; light travels faster in air than in water and other highly refractive substances. So that theory broke down, and the Undulatory Theory has been accepted in its stead, it having been found to lead to conclusions consistent with actual experiment. According to this theory, a certain highly elastic medium is supposed to exist everywhere

in space. The densest solid is permeated with it, as well as the rarest gas or the farthest realms of airless space. This medium is known as the luminiferous ether, agitation throws it into a state of vibration, and the vibration may be propagated in waves of different lengths, travelling with different velocities. Any luminous body is continually sending out these ethereal waves in every direction; those that enter the eye disturb the ether there, and produce an effect on the retina which causes us to *see*. If on its way a wave meets with a plate of glass, the ether in the glass itself takes up the vibrations and hands them on to the other side; this is the case with all transparent substances. Opaque substances are unable to pass the ethereal waves on, and hence the light is stopped. The eye, however, is not affected by all the vibrations capable of being transmitted by the ether; only those of certain wave-length cause any sensation to be carried by the optic nerve. The waves which we call light-waves are extremely short, varying from .00003933 to .00007604 centimetres, according to their colour, those of blue being shorter than those of red light. Shorter waves still rush through the ether and produce definite effects, though the eye cannot detect them. Phosphorescent substances can grasp them, and photography eagerly picks them out. Longer waves we feel as heat, and the waves of electric disturbance may be many miles in length. Maxwell supposed that all these ethereal waves were the effect of electromagnetic disturbance, and his theory, though incomplete at the time of his death, is being gradually elaborated, and is found to explain in the most satisfactory way many of the observed phenomena in optical science. [RADIATION.]

Ungulata (HOOFED MAMMALS), an order of Mammals, with two sub-orders, Artiodactyla and Perissodactyla (both which *see*). The Hyracoidea and Proboscidea are now generally included.

Uniformity Act, THE. An Act for securing uniformity of ceremonies, doctrines, and formularies in the Established Church of England, was passed in 1662. An Act had already passed in this direction in Elizabeth's reign. One immediate effect was to drive many clergymen out of the Church. An Amendment Act was passed in 1872.

Union, the tie that binds (1) Scotland, (2) Ireland politically to England. The *Crown* of Scotland became united to that of England under James I. in 1603; but the Parliament of Scotland did not cease till 1707, in which year it was decided that one Parliament should administer the affairs of the two nations, and that the same custom laws, weights and measures, etc., should prevail in both countries. Scotland received the right of sending 16 representative peers to the English House of Lords and 45 members to the House of Commons; it was allowed to retain its Established Presbyterian Church, and its own law courts, judges, and system of law. Ireland, which from the time of Henry VIII. was looked on as part of the kingdom, lost its Parliament in 1801, but not under so favourable conditions as Scotland a century before.

Unitarians, or believers in One God, is a term that in its widest sense would cover Jews, Mohammedans, and many sects of the Church; but it is generally restricted to those of modern times in England and her colonies, including America, who deny the divinity of Christ, or at any rate His equality with the Father. The body of Unitarians, as we now know it, dates from 1730, its great preacher having been a man named Emlyn. The doctrines of Unitarianism are by no means new; the Sabellians and Arians of the early Church held similar doctrines, and the Athanasian Creed was compiled to counteract the views of the Arians. Similar views have also prevailed at different times in parts of the English Church, and the holders of them have been persecuted. The English Unitarians have sometimes been held to have been the representatives of the Presbyterians driven out by the Act of Uniformity. They had troublous times till the passing of the Toleration Act in 1689, but have since that time been left very much to their own devices. Some hold that Christ was a good man who suffered for truth's sake, while others place Him in a sort of quasi-divine position. Some are advocates of adult, others of infant baptism. Their system is congregational, so there is no formulated general creed. Where they observe the Lord's Supper it is as a commemorative act, and not as a sacrament. Among writers who have had influence among them may be mentioned Priestley, Channing, Emerson, and Martineau.

United Presbyterians, a division of the Presbyterian Church of Scotland, having its origin in the union (1847) of the Secession Church, formed in 1733 under the auspices of Erskine, with the Relief Church, formed in 1752 as a protest against patronage and to vindicate the right of election of incumbents. Various attempts have been made to reconcile the United Presbyterians to the mother Church.

Units are the standards of reference in terms of which we measure any concrete quantity. Thus we may measure a length in feet or metres, in which case the foot or the metre is the unit of length. That such standards should be absolutely fixed is obviously necessary. Although in olden days many pounds were in use, and each pound had its name, *e.g.* the tower pound, merchant's pound, etc., and indicated a definite mass, nevertheless it is extremely probable that the existence of many different standards made it more difficult for the ignorant to avoid being the victims of commercial deception. In modern times the tendency has been to reduce the number of units as far as possible—to have, in fact, only one unit for each kind of quantity. We in England, however, are far from perfect in this respect, as is testified by the existence of the pounds troy and avoirdupois as units of mass, while area on a small scale is given in square feet at the same time that a field is measured in acres. A gallon and a cubic foot are both units of volume, but memory must play its part in connecting one with the other, as well as in the reduction of acres to square feet. This

kind of multiplicity of units arises from the fact that our whole system is perfectly arbitrary and wholly unscientific. There is no connection between our common units of volume or area and that of length. A scientific system, on the other hand, chooses its unit of area to be the square of its unit of length, and its unit of volume to be the cube of the same. This simple state of things exists in the centimetre, gram, second, or C.G.S. system, and it is therefore adopted in scientific work all over the earth. In it the centimetre (equal to $\frac{1}{39.4}$ of an inch) is the unit of length, the square centimetre that of area, while volume is estimated in cubic centimetres. The unit of mass is the gramme, that being the mass of a cubic centimetre of pure water at the temperature at which it has its maximum density (4° C.); and the unit of time is the second. Again, instead of having to execute a series of mental gymnastics, such as are required in transforming a certain number of, say, ounces into tons or inches into furlongs, all such changes are made by means of a multiplication or division by powers of ten. The so-called "dry measure" has no analogy in a scientific system, so that one is spared the inconvenience of endeavouring to realise what is meant by, say, a chaldron of coke, even if one does succeed in reducing it to bushels, since such a substance can only be reasonably estimated by weight. A unit, such as that of length or volume, which is defined by reference to another unit—in this case, that of length—is termed a *derived* unit.

Universalists are the members of a school of theology or philosophy which holds, with different modifications, the doctrine that all mankind will reach a final state of happiness hereafter, with perhaps a passage, in this world or elsewhere, through a period of expiatory probation. The doctrine, which has had a considerable development in America, owed much of its impulse to the Rev. J. Murray, who went to New Jersey in 1774, and became the disciple of Mr. Rely, who was an advocate of its tenets. Mr. Ballou also did much to spread it in the latter part of the 18th century. The Pelagians of old held the doctrine, as do also many Unitarians.

Universalism. [UNIVERSALISTS.]

Upas Tree, the native name of *Antiaris toxicaria*, a very poisonous artocarpaceous tree of Java, about which many fabulous stories were circulated during the last century. It grows sometimes in the dormant volcanic craters of the island, where the exhalation of the heavy and suffocating carbon-dioxide kills insects, fish, birds, tigers, and even man—effects attributed to the tree. Its milky latex, however, is caustic, acrid, and poisonous, being known as *antiar* to the Javanese. It dries, on incisions made in the bark, into the gum-resin known as *upas*, with which the natives poison their arrows and kris.

Upsala, the former capital of Sweden, stands on the Sala, 45 miles N.W. of Stockholm, and is one of the most ancient cities of Scandinavia. The cathedral, in which the kings were crowned, dates

from 1258, and the university was founded in 1477. There is also an ecclesiastical college; and the Archbishop of Upsala is Primate of Sweden. Besides the manufacture of silk fabrics and tobacco in small quantities and a little river trade, no commerce is carried on. It is the chief town of the laen or administrative district of the same name, which has an area of 1,978 square miles, and contains important iron-mines.

Urachus, a fibrous cord connecting the summit of the bladder with the anterior abdominal wall.

Uræmia, the condition in which, owing to defective excretory action on the part of the kidneys, certain products are retained within the system, and circulate in the blood. The chief phenomena produced by such retention are cardiac hypertrophy, thickening of the smaller arterioles, dropsy, and certain congestions and inflammations. But the characteristic symptoms commonly spoken of as uræmic symptoms are more particularly the nausea, vomiting, diarrhoea, hurried respiration, drowsiness, coma, and convulsions, which sometimes occur. When the more serious of these symptoms are present, the patient is said to suffer from an uræmic fit. [BRIGHT'S DISEASE.]

Ural or Oural Mountains, THE, a range extending from the Arctic Ocean to the N. of the Aral Sea, and separating European from Asiatic Russia. It has a length of about 1,330 miles and a breadth at most of 60 miles, the average elevation being 3,000 feet, though some points rise to 5,500 feet. Composed mainly of crystalline schists and igneous rocks, the Urals are exceedingly rich in precious metals, *e.g.* gold, platinum, iridium, green carbonate of copper. Diamonds are also found. The Petchora, Kama, Ufa, and other rivers rise here, the chief being the URAL, which flows for 1,046 miles into the Caspian Sea. Orenberg is on its banks.

Ural-Altaic Languages, a linguistic family of the agglutinating order of speech, current throughout the domain of the Ural-Altaic race (q.v.), and also spoken in Hungary. Excluding the Korean and Japanese, as well as the extinct Accad of Babylonia and the Etruscan of Etruria, whose relations to the Ural-Altaic group are still a moot question with philologists, there are five clearly-recognised branches, with numerous subdivisions, as under:—(1) *Ugro-Finnic*, including Finnish, Lapp, Esthonian, Mordvinian, Permian, Ostiak, Vogul, and Magyar; (2) *Samoyedic*, including Yurak, Tagvi, and Kamasin; (3) *Turkic*, including Uigur, Chagatai, Kipchak, Osmanli, Chuvash, Yakut, and Siberian "Tatar;" (4) *Mongolic*, including Sharra, Kalmuk, and Buriat; (5) *Tungusic*, including Tungus proper, Manchu and Lamut. These branches must have ramified from a common centre—probably the Altai uplands—at an extremely remote epoch, for the divergence between them is far greater than between the several branches, not only of the Semitic, but even of the Aryan family. Thus, the difference between Magyar and Lamut, for instance, is greater than between Italic and Hellenic, or even Indic. Nevertheless, the relation-

ship is thoroughly established, and is based not only on the identity of a considerable percentage of primitive words, but also on certain phonetic and structural resemblances pervading all the branches. Of these resemblances the most characteristic is the arrangement of the formative elements, which are always postfixed—that is, tacked on somewhat loosely to the root, which remains unchanged, while the vowels of the postfixes are modified to harmonise with that of the root, in accordance with the so-called principle of vocalic harmony. Thus, in Turki: *rûh*, spirit; *rûh-ân*, of the spirit; *rûh-lar*, spirits; *ruh-lar-un*, of the spirits; but *dil*, tongue; *dil-in*, of the tongue; *dil-ler*, tongues; *dil-ler-in*, of the tongues, where the strong *u* of root *ruh* determines the strong *u* and *a* of the postfixes *un*, *lar*, which similarly become *in*, *ler*, after the weak *i* of root *dil*. The true agglutinating character of these particles is also shown by the intrusion of plural *lar*, *ler*, and consequent shifting of *un*, *in*. Such a process is absolutely impossible in the inflecting order of speech, where the formative elements are more thoroughly fused with, and consequently inseparable from, the root, as in the Latin *anima*, *animæ*, *animas*, etc. Another remarkable feature of the Ural-Altaic languages is the extraordinary development of verbal or quasi-verbal forms—actives, passives, negatives, interrogatives, dubitatives, causatives, reciprocatives, and many others—all built up by the same syntactical process, and yielding almost endless possible combinations, nearly 30,000 in the Turki conjugation, and far more in Mordvinian and some other members of the Finnish group. Thus, in Turki: *bil-mek*, to know; *bil-me-mek*, not to know; *bil-mi-mek* and *bil-mi-me-mek*, to know and not to know, put interrogatively; *bil-il-mek*, to be known; *bil-dir-mek*, to make known; *bil-der-il-mek*, to be made known; *bil-der-me-mek*, not to make known; *bil-der-il-me-mek*, not to be made known, etc. etc., each of these being inflected through its several persons, numbers, tenses, moods, participial and gerundial forms. This agglutinating system may be said to run riot in some of the groups, becoming so cumbrous through the heaping-up of particles according to rigid law that it tends to break down under its own weight. It is at this stage of threatening disintegration that symptoms are observed of a gradual transition from agglutination to true inflection, as in Finnish, and especially in the Siberian Ostyak, where in certain positions the root-vowel itself becomes modified—that is, acquires grammatical force independently of the postfixes. Syncope is also at work, as seen in the Turki *bol-up-irdi*, which in Yarkandi (Kashgaria) is shortened to *bolupti*, and in Constantinople to *wopti* = “it had become.” All this interferes greatly with the delicate laws of vowel harmony, which once disturbed are never revived, but gradually give place to more convenient inflecting processes, as developed especially in the Aryan system. (Castrén, Böhlingk, Redhouse.)

Ural-Altaic Race (MONGOLO-TATARS), one of the main branches of the Mongolic or Yellow division of mankind. Although purely geographical and

defective, the Ural and Altai ranges being very far from covering the whole area, the expression *Ural-Altaic* is to be preferred to *Mongolo-Tatar*, which is both defective and inaccurate, in fact, tautological, *Mongol* and *Tatar* being, strictly speaking, synonymous ethnical terms. [TATAR.] There are four well-marked groups—The *Tungus* and *Manchus* of North-East Asia as far west as the Yenisei and south to the Amur basin; the *Mongols* of Central Asia (Mongolia, Baikal, parts of Tibet), with an outlying group in European Russia (Lower Volga); the *Turks*, improperly called “Tatars,” of Western Asia, the Balkan Peninsula, Caucasasia, and parts of European Russia; the *Finns* (with the Lapps and Samoyedes) of North-East Europe and North Siberia as far east as the Yenisei. Excluding the Koreans and Japanese, doubtful members of the family, and the Bulgarians and Magyars of Hungary, originally Finno-Turks, but now assimilated to the Caucasian type, these various branches of the Ural-Altaic race occupy an area of not less than 10,000,000 square miles, with a total population of about 50,000,000, of whom 30,000,000 are Turks, 13,000,000 Finns, 5,000,000 Mongols, and 2,000,000 Tungus and Manchus. Owing to secular interminglings with the peoples of the west (Iranians and Europeans of Aryan speech), the western groups present almost every shade of transition between the Mongolic and Caucasian types; but the fundamental unity of the race is established both by their common Ural-Altaic speech and by a few salient physical traits, such as a yellowish complexion, black lank hair, small slant eyes, somewhat flat features, brachycephalic (round) head, short stature, generally below the European average. Amongst many of the Finnish and Turkish groups these traits have been almost obliterated by miscegenation, so that it is extremely difficult to draw the line between Mongol and Caucasian about the ethnical borderlands. For details, see FINNS, MONGOLS, TURKI.

Uralite, a peculiar variety of hornblende, resulting from the alteration of augite crystals. The apparent form of the crystal is thus identical with that of augite, but the mass really consists, not of this substance, but of a great number of minute hornblende crystals. It derives its name from the localities where it was first found, though it has since been seen to be tolerably widely distributed in igneous rocks.

Uranite, a rather rare mineral which occurs chiefly in Cornwall, Saxony, Bohemia, and Belgium. It crystallises in the tetragonal system, and forms lustrous, emerald-green, semi-transparent crystals, rather soft, and possessing a specific gravity of 3.5. It consists chemically of the phosphate of copper and uranium, a lime uranite also occurring, in which the copper is largely or wholly replaced by calcium.

Uranium (U. 240) is a metal which does not occur to a great extent in the crust of the earth, and of which the chief ore is pitchblende. Its existence in this source was first shown by Klaproth in 1789, but the pure metal was not prepared until over half a century later. Pitchblende consists

chiefly of oxides of uranium, which may be present to the extent of ninety per cent., and is found in many localities, notably Cornwall. Combined with other rarer metals, uranium also occurs in the minerals *samarskite* and *euxenite*. As obtained from its salts by reduction with sodium, it is a white metal, malleable and hard, which does not oxidise and tarnish in air, and which possesses the high specific gravity of 18.33. It forms a large number of oxides, of which the trioxide (UO_3) acts as an acid forming salts, the *uranates*, which somewhat resemble the chromates. It forms also three chlorides by direct union of the elements. Of these the pentachloride (UCl_5) is interesting as existing in two varieties, both very hygroscopic, and decomposed by water. The metal also forms a number of oxysalts, the *uranyl* salts, which are usually yellow soluble compounds. The nitrate is also called uranium nitrate ($\text{UO}_2 \cdot \text{N}_2\text{O}_6 + 6\text{H}_2\text{O}$), and is used in photography as an *intensifier*, while printing processes dependent upon the use of the same salt may be employed.

Uranoliths (HEAVEN-STONES) are the pieces which fall to the earth from a meteor (q.v.) during the passage of the latter through the sky. They are more commonly called meteorites or meteoric stones, the name *aërolites* (air-stones) being also occasionally given to them.

Uranus was discovered by Herschel in 1781 (March 13th), and is the next planet beyond Saturn, being 1,783 million miles from the sun. His diameter is over 33,000 miles, and his volume is about ninety times that of the earth. His density is about $\frac{1.5}{10}$ that of the earth, rather less than that of water, so that his mass is about fifteen times as much as that of the earth, an amount which makes him more than outweigh Mercury, Venus, the Earth, and Mars combined. All astronomers do not agree in their estimation of these numbers, Uranus being too far away for measurements to be more than approximate. Gravity on his surface is only three-quarters of what it is here, so that a ponderous beast here could move about with springful alacrity if transported through space to that far-off planet. Uranus, being so far from the sun, naturally loses the benefit of his light and heat: in fact, to an inhabitant of Uranus—if there be one—the sun would merely appear as a bright star does to us. A great peculiarity exists in the arrangement of his satellites. Unlike those of other planets, they do not move approximately in the plane in which the planet travels, but circle him in a plane nearly at right angles to his orbit (about 76°).

Urao is a deposit which is found at the bottom of a lake near Nerida, South America. It consists of a hydrated carbonate of soda, and is also known as *trona*.

Urari. [CURARA.]

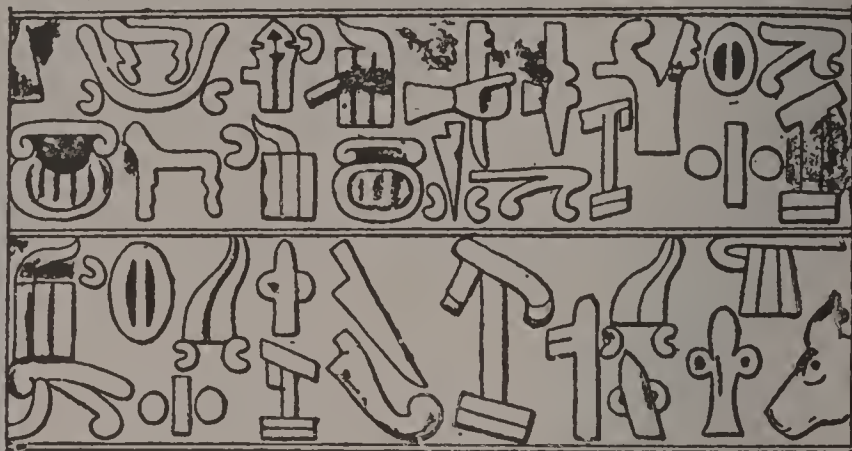
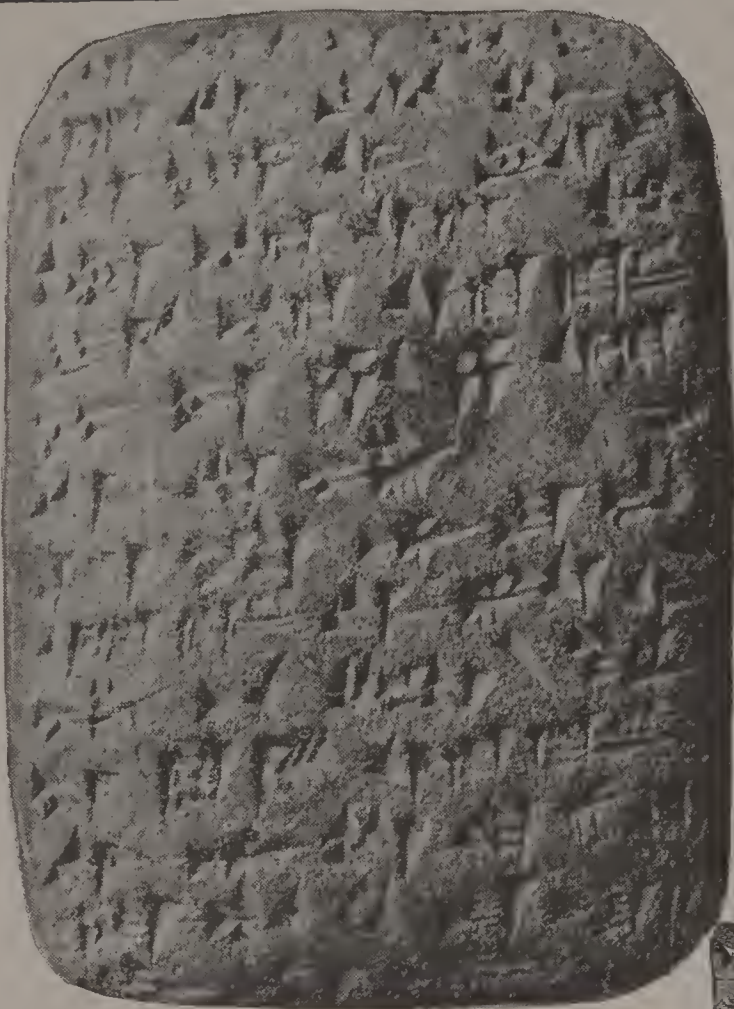
Urban, a name borne by eight of the Popes, of whom the first suffered martyrdom. Urban II., by his action at the Council of Clermont (1095), was the prime mover in the establishment of the Crusades. Urban VI. caused great confusion in the Church by his obstinate resistance to the

cardinals, who deposed him in 1378, a schism being the result. Urban VIII. was probably the greatest of his name, a patron of art and literature, an excellent scholar and poet, and a strong upholder of the temporal power.

Urbino (Class. Urbinum Hortense), a city of Central Italy, formerly the capital of a duchy, and now the chief town of the province of Urbino. Pesaro, is situated 20 miles S.W. of Pesaro. It is the seat of an archbishopric, and contains a ducal palace, cathedral, and seminary. Raphael was born here in 1483. It is a centre of local trade, and has a factory for the production of pins.

Urea. This compound had long been known as a constituent of the urine not only of mammals, but also of reptiles and birds, and had been early obtained from human urine. In 1828, however, it was synthesised by Wöhler, who showed it could be prepared from purely inorganic compounds. This being the first artificial preparation of a so-called organic compound, was the first of the now very numerous preparations which demonstrate that between the organic and inorganic compounds there is no essential difference. To prepare urea from urine the liquid is evaporated to a syrupy consistency, and nitric acid is added, by which a salt of urea (*urea nitrate*) is precipitated. This is purified by recrystallising, and from it the urea itself is easily obtained. The artificial preparation is most easily effected by Wöhler's original method, *i.e.* by heating ammonium iso-cyanate, when a molecular transformation takes place, and urea is formed. The composition of urea is represented by CON_2H_4 , and the equation for this change is therefore $\text{NH}_4\text{NOC} = \text{CON}_2\text{H}$. It is a white crystalline compound, which forms rhombic needles, with a taste somewhat like that of saltpetre. It is very soluble in water and alcohol, but nearly insoluble in ether. It acts as a strong organic base, uniting with acids to form salts—*e.g.* *urea nitrate* ($\text{CON}_2\text{H}_4 \cdot \text{HNO}_3$), a crystalline salt—*urea oxalate* $2(\text{CON}_2\text{H}_4) \cdot \text{C}_2\text{O}_4\text{H}_2$, a white, almost insoluble salt, etc. Its solution, exposed to air, slowly decomposes, forming carbonic acid and ammonia, the same decomposition occurring with urine. Its constitution appears to be $\text{CO}(\text{NH}_2)_2$, but other views are urged by many chemists. It yields a large number of derivatives by substitution of hydro-carbon radicals for the hydrogen of the urea, many of these compounds being important physiological substances. The quantitative determination of urea in urine is a matter of considerable importance in medicine, and for it several methods are available.

Uri, one of the four forest cantons of Switzerland, lying south of Schwyz and east of Unterwalden, with which two it combined to form the original Swiss Confederation. The area is 422 square miles, and consists mostly of mountain and forest, with some arable land along the course of the Reuss. Mount St. Gothard overshadows the southern border, and to the west runs the main range of the Alps. Altorf is the capital. In 1799 it was the theatre of war between the French and Austro-Russian allies. The lake of Uri, the S.E.



11.11.15
 11.11.15
 11.11.15

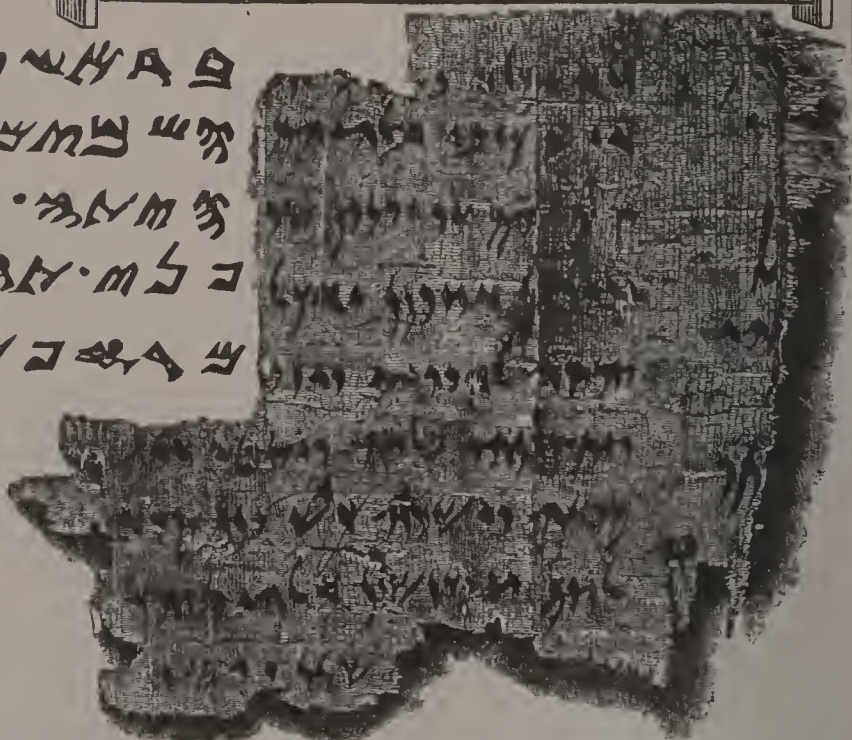


10
 A M C H V > O J T I V V R V V N
 V I > J D A I N A N T V >
 < P H I N V I > A I L J N I O I
 > I J X I > D V V L I J I > D V C L > A M I
 J I V L V C W J I K I A > O I I O K
 C O I A J I A V J K Y I X P H I X
 H I M O N V I V T J I > I O C A I I
 N A V J N < A N V V V I I I > J C +

5
 ΑΥΤΟΥ ΑΠΟ ΤΟΥ ΞΥ
 ΛΟΥ ΤΗΣ ΖΩΗΣ ΚΑΙ
 ΕΚ ΤΗΣ ΠΟΛΕΩΣ
 ΤΗΣ ΑΓΙΑΣ ΤΩΝ ΓΕ
 ΓΡΑΜΜΕΝΩΝ ΕΝ
 ΤΩ ΒΙΒΛΙΩ ΤΟΥΤΩ
 ΛΕΓΙΟΜΑΡΤΥΡΩΝ
 ΤΑΥΤΑ ΕΙΝΑΙ ΕΡ

H H . 50324. 142. 100 142 100
 100 142 100 . 142 142 . 142 142 . 142 142
 20 . 142 142 . 142 142 . 142 142 . 142 142
 100 142 142 . 142 142 . 142 142 . 142 142
 142 142 142 . 142 142 . 142 142 . 142 142
 142 142 142 . 142 142 . 142 142 . 142 142

術有善行

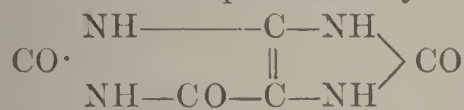


WRITING.

1 Tablet from Tell-el-Amarna. 2 Hittite inscription. 3 Egypto-Aramaic inscription. 4 Cuneiform inscription. 5 Greek writing. 6 Runic. 7 Facsimile of Samaritan Pentateuch. 8 Chinese writing. 9 Specimen of Aramaic writing.

portion of that of Lucerne, has very precipitous shores, and receives the waters of the Reuss.

Uric Acid possesses the composition represented by $C_5H_4H_4O_3$. It is present, though not to a large extent, in human urine and in that of other mammals. In the excrement of birds and reptiles, however, it occurs in very considerable quantities, either free or combined with ammonia. From these sources the compound is best obtained, guano being most easily available for the purpose. The excrement is dissolved in hot dilute potash, and sulphuric acid is added to the solution, when the uric acid is precipitated as a white powder. It may also be prepared synthetically, but the reactions are by no means simple, and do not completely elucidate its constitution. It is almost insoluble in water, alcohol, and ether, and acts as a weak dibasic acid, but in most of its salts only one hydrogen is replaced. On heating, it decomposes into urea and other products. Its constitution appears to be best represented by the formula—



and is thus very closely allied to theobromine, theine, xanthine, and other important compounds. It occurs normally in small quantities in the blood and muscle juices. Under certain pathological conditions it separates out between the joints and in the muscles, giving rise to that painful complaint the gout, while it also becomes at times deposited in the bladder, with the formation of "gravel."

Urim and Thummim (LIGHT AND PERFECTION or DOCTRINE AND TRUTH) was the Hebrew name which denoted an instrument of divination which was in use among the ancient Hebrews, and which was in some way connected with the breastplate worn by the High Priest. Commentators on the Bible, which makes more than one mention of Urim and Thummim, are in doubt whether the name applied to the whole breastplate or only to certain jewels upon it. Jewish writers consider that the oracle made itself known by exceptional brightness in the jewels.

Urinary Tubes. [URINE.]

Urine. Healthy urine is a transparent straw-coloured fluid of slightly acid reaction, of a specific gravity of about 1.020. The quantity of the constituents is subject to variations in accordance with season and the amount of drink and exercise. The average composition in 1,000 parts by weight may be given, however, as 967 parts of water, about 15 parts of urea, and about 10 parts of other nitrogenous crystalline bodies, what remains consisting chiefly of mineral salts. About 52 fluid ounces of urine are passed by a healthy male adult in the course of 24 hours, containing some 512 grains of urea, about 8 grains of uric acid, 10 to 15 grains of hippuric acid, and about 150 grains of nitrogenous extractives, while of the mineral salts the large bulk is composed of chlorides, and there are small quantities of phosphates and sulphates, the bases with which the several acids are combined being the fixed alkaline bases, with a little lime and

magnesia. It should be mentioned that the urine contains certain pigments derived from the pigment of the blood, and there is always a small amount of mucus shed from the mucous surfaces of the urinary passages. When urine is allowed to stand it throws down deposit, which contains mucus and under some circumstances phosphates, while under other circumstances it may contain urates and uric acid. Certain abnormal constituents are found in the urine in disease. The most important of these are albumen, sugar, the pigments of the blood, and bile, and in some instances materials which can be detected on microscopic examination, and which may afford an important clue to the nature of the malady from which the patient is suffering. The presence of albumen is commonly tested for by ascertaining whether coagulation is produced by the action of heat or on the addition of nitric acid [BRIGHT'S DISEASE], while a number of tests may be employed to ascertain whether sugar is present, the most important being that known as Fehling's test. [DIABETES.]

Urochordata, a synonym of Tunicata (q.v.).

Ursa Major, popularly known as the Great Bear, is one of the best-known constellations of the northern hemisphere. It was known as the Bear or the Waggon by the early Greeks, it, like other constellations, being named from some imaginary resemblance to more familiar objects. It is now often spoken of as King Charles's Wain, the Waggon, and the Plough. There are seven bright stars in the Plough, three of which are known as the "handle" and two as the "pointers." The last are so named from the fact that a line produced through them passes very near the Pole-star. There are, however, many more stars than seven in the constellation; about sixteen can even be detected by the naked eye. The seven stars were called by the Romans the Seven Ploughing Oxen or Septem Triones, and from this we get the word septentrional for north. URSA MINOR is less noticeable in the sky, its brightest star, α (the Pole-star) being only of the third magnitude. It has been called the Dog's Tail (cynosure), on account of the curve formed by three of its stars. Two thousand years ago it was the star β , and not α , which was nearest to the celestial pole, and was therefore the "Pole-star." Neither the Great nor Little Bear is ever lost, to view below the horizon to inhabitants of the northern hemisphere above lat. 40° .

Ursidæ, a family of Arctoidea (q.v.), containing the Bears. There are five digits on each limb, all armed with strong, curved, non-retractile claws, tongue smooth, ears small and erect, and tail short. Many are in large part vegetable feeders.

Urticaceæ, an order comprising 1,500 species in 108 genera, occurring in all parts of the world, but mainly tropical. Its members all agree in their apetalous flowers, with stamens equal in number and opposite to the sepals, and superior, one-chambered, one-ovuled ovary; but it includes such varied types that it has been termed "the marine-store shop of botanists," and is often separated into the orders Urticeæ, Moreæ, Ulnaceæ,

Celtideæ, and Cannabineæ—*i.e.* the nettles, mulberries and figs, etc., elms, Celtis, and hemp and hops. These groups differ in their latex, stipules, albumen, and in the direction of their ovules. The Urticææ comprise over 40 genera and 500 species, with erect atropous ovules, albuminous seeds, and very tough fibrous inner bark. With the exception of the two British genera, the nettles (*Urtica*) and pellitory (*Parietaria*), they are all essentially tropical. The most useful genus is *Bahmeria*.

Urticaria, or NETTLE-RASH, an eruption of wheals, often occurring in some persons after eating shell-fish or other food. It is almost always the result of gastric derangement.

Uruguay, or BANDA ORIENTAL, a republic of South America, lying S. and W. of Brazil, north of the estuary of the Plata, and N. and N.E. of the Argentine Confederation, with an area of about 70,000 square miles. Level on the coast, the country rises to the vast rolling plains of the Pampas, until it reaches the forest-clad ranges of the Cuchilla de Hoedo and other offshoots of the Cordilleras. The Uruguay and its tributaries, chief of which is the Rio Negro, drain the district and provide water-carriage. Cereals and fruits of all kinds can be grown abundantly along the river-courses, but the breeding of cattle, sheep, and horses is the chief source of wealth, large quantities of frozen and tinned meat being exported to Europe. There are great mineral resources, as yet almost unexplored. Originally a dependency of Buenos Ayres, and under the Government of Brazil, the colony proclaimed its independence in 1825, and was recognised by the Treaty of Montevideo some four years later. Montevideo, the capital, is on the north bank of the Plata. The river Uruguay rises in lat. 26° 30' S., and, after a circuitous course of about 800 miles, joins the Parana and Plata 35 miles above Buenos Ayres.

Urus. [AUROCHS, BISON.]

Uses. [STATUTE OF USES.]

Ushant (French *Ouessant*), an island off the coast of Brittany, France, in the department of Finisterre, and 26 miles W.N.W. of Brest. It has a circumference of 10 miles, the coast being steep and rocky and crowned by a lighthouse. A number of sheep are pastured on the uplands, but the population is mainly dependent on fishing. Lampaul is the chief centre. The French were defeated off the island in 1759 by Hawke, and an indecisive battle was fought in 1778 between Keppel and D'Orvilliers.

Usury is sometimes used to signify extortionate or illegal interest upon loans, and sometimes is taken as synonymous with the whole practice of lending money upon interest. The Fathers of the Church and canon law condemned the taking of interest, and the law of Moses placed certain restrictions on it and forbade Hebrews to exact it from their fellow-countrymen. Laws have at different times been passed in England to regulate the amount of interest legally recoverable.

Utah, a territory of the United States of America, occupying an area of about 85,000 square miles,

between Idaho and Wyoming N., Arizona S., Nevada W., and Colorado and Wyoming E. It is traversed from E. to W. by the Wahsatch Range, attaining an elevation of 15,000 feet, and has vast swelling prairies towards the E. The Colorado, Green, Grand, Virgin, Jordan, Bear, and Levier Rivers effect the drainage, and lakes abound, Great Salt Lake being the largest. On its shores stands Salt Lake City, the capital, and other important centres are Ogden and Provo. Grazing is the chief industry, but the soil about the rivers is fertile, and yields good crops of cereals and fruit. The timber on the mountains forms a valuable product, and silver, lead, gold, copper, and iron are worked with profit. The district was occupied by the Mormons, who still form the bulk of the population, in 1847, and was organised as a territory in 1850.

Utahs (UTES), North American aborigines, forming a main division of the Shoshonean (Snake) family; formerly widespread, but never numerous, in the Colorado uplands, in North New Mexico, parts of California and Nevada, and in Utah, which state is named from them. Chief tribal groups: Gos Utes, still at large in Utah; Pai Utes, scattered over South-East California and South-West Nevada; Utahs, some in the Ute Agency, Colorado, some in the Ouray and Uintah Reserves, Utah.

Uterus. The uterus or womb is in the unimpregnated state a pear-shaped body, about three inches long, consisting of an expanded upper part, the *fundus*, about two inches in breadth, the *body* of the uterus, about one inch in breadth, and the somewhat constricted *cervix* or neck, where the uterus is attached to the vagina. The cavity of the uterus communicates below by means of the os uteri with the cavity of the vagina, and on either side of the fundus it has opening into it the canals of the Fallopian tubes. The various diseases to which the uterus is liable form a part of the subject-matter of the science of gynæcology. It may here be noted that the uterus is occasionally affected by displacement, that its structures may be involved in inflammatory processes, and that certain tumours may be developed in connection with it. Of the last-named the most important are the growths of fibrous and muscular tissue, known as "uterine fibroids," and certain forms of malignant disease.

Utilitarianism was first used, to signify a particular standard for judging actions, by Jeremy Bentham, who is said to have borrowed the expression from Galt's *Annals of the Parish*; but the great exponent of Utilitarianism as a philosophical doctrine is John Stuart Mill. In his treatise upon the subject he sets up the general happiness as the end to be aimed at by human actions, and the standard by which such actions are to be judged is their fitness in bringing about the end aimed at. According to this view, it is by no means necessary that this utility be the apparent and conscious motive of any particular action, but only that such utility be the ultimate standard by which it be tested.

Utrecht (Roman *Trajectum ad Rhenum*), a province and its capital in the kingdom of the Netherlands. The former has an area of 534 square miles, being bounded N. by North Holland and the Zuyder Zee, W. by South Holland, and E. by Guelderland. Except in the S. the surface is level, and affords excellent pasturage. The Leck, Eem, and Vechte are the chief rivers. The city is the most ancient in Holland, and was the seat of a bishopric late in the 7th century. It stands on the Old Rhine 20 miles S.E. of Amsterdam. Among many interesting buildings are the cathedral of St. Martin, two other cathedral churches, the Pope's House (built by Adrian VI.), the Mint, the University (founded in 1630), and the Stadthaus or town-hall. The chief industries are plush-weaving, carpet-making, tobacco, and books.

Uzbegs, a main branch of the Turki race, dominant since the 16th century in Western Turkestan (Khiva, Bokhara, Ferghana, Afghan Turkestan), originally nomads, but now mostly settled, engaged in agriculture and trade, and much mixed with the indigenous Tajik (Iranian) populations, as shown by their greatly modified Mongolic type; claim descent from Uzbeg, a renowned chief of the Golden Horde (1312-42), under whom they first made their appearance on the Caspian Sea, and thence gradually overran a great part of the Turkestan Lowlands; but many local traditions, as well as tribal names, point to an intermingling of Mongolic, Turki, and even Finnish tribes, amongst whom the Turki element no doubt greatly predominated, as is evident from the universal prevalence of the Turki language (Chagatai dialect). This Turki element has been traced with much probability back to the *Euz* or *Guz*, an ancient Turki people, akin to the Ugurs, who were seated in the Tian-Shan uplands, and mentioned in the Chinese records under the corrupt name of *Kiu-tze* or *Ku-tze* some centuries before the new era. The Euz hordes had already reached the Sirdarya (Jaxartes) in the 10th century, and it was from that point that they advanced round the Aral Sea to the Caspian; the kindred Turki people of the Volga still call them *Oz*. Although long settled and dwelling in large cities, such as Khokand, Khiva, Bokhara, and Samarkand, the Uzbegs still preserve the original tribal groups, of which over 100 are enumerated. One of these are the *Uzi*, and others, such as the Manghits, Kitais, Naimans, Kipchaks, Kungrads, Kalmaks, Ugurs, Kara-Kalpaks, and Chagatais, clearly indicate a medley of Mongol and Turki tribes, so that the term Uzbeg is regarded by Vambéry and others rather as a political than an ethnical designation. (Vambéry, De Ujfalvy, Trotter, Burnes, Meyendorf.)

V.

V, the twenty-second letter of our alphabet, related to F as the voiced to the voiceless labio-dental consonant. It was the original form of U, and it is only lately that the two letters have been

strictly appropriated to different uses. In Anglo-Saxon and Early English the sounds of both V and F are represented by F, which is voiced in the middle, voiceless at the beginning of a word. It is almost certain that the Latin V had the sound of W. This transformation from the labial to the labio-dental took place in the course of the formation of the Romance languages. V is also a labial consonant in Old Norse or Icelandic. When initial in modern German it is a symbol for the sound F.

Vaccination (Latin *vacca* = "a cow"). Towards the end of the last century Edward Jenner, a surgeon practising in Gloucestershire, was led to make inquiry into the truth of a notion to which his attention was directed, to the effect that milkers and others who had suffered from cowpox were incapable of contracting smallpox (variola). Jenner instituted a number of experiments, and published his results in 1798 in his work entitled *An Inquiry into the Causes and Effects of the Variolæ Vaccinæ*. In each of the two following years he published further papers on the subject, which was taken up by other observers, and speedily assumed considerable prominence. Jenner held that material taken from a particular kind of eruptive malady affecting the teats and udders of cows possessed the power, when inoculated into the human subject, of protecting from smallpox. The particular cow-disease in question he called variolæ vaccinæ; hence the title of his first paper, and hence the application of the term vaccination to this method of preventing an attack of smallpox. The efficacy of vaccination was tested by numerous inquirers, who satisfied themselves that a person who had been submitted to the operation acquired protection against an attack of smallpox, as tested by a subsequent inoculation with smallpox matter; and vaccination during the early part of the present century gradually superseded the method of smallpox inoculation which had hitherto been largely adopted with a view to preventing a severe attack of variola. Vaccination was taken up abroad, and in this country it obtained so much favour that it was enacted in 1838 that it should be provided gratuitously, and in 1854 it was made compulsory. In 1871 an Act was passed providing for the systematic enforcement of vaccination, and for the appointment of paid vaccination officers. On the other hand, the old operation of variolous inoculation, which had gradually fallen into disuse, was in 1840 made illegal on account of the risk of the communication of infection, from those who had been submitted to the operation, to unprotected persons. With the disuse of variolous inoculation the possibility of applying the test employed by the early observers, of insusceptibility to variolous inoculation subsequent to a successful vaccination, was no longer available. A mass of statistical evidence, was, however, becoming accumulated, showing the effect of vaccination upon the incidence of smallpox. While, however, this evidence clearly showed the importance of vaccination as a means of protection, it was found that such protection did not last for an indefinite period, and the desirability of repeating the operation

after the lapse of a term of years became manifest. It was, moreover, ascertained that in cases where smallpox attacked persons who had been vaccinated, but the protective influence of whose vaccination was not sufficient to altogether prevent the manifestation of the disease, the severity of the malady was in direct relation with the number, extent, and character of the vaccination marks. The importance of revaccination and of the proper performance of the operation of vaccination thus became recognised. The law now provides that every child shall be vaccinated within three months of its birth, unless a certificate signed by a qualified medical man is produced to the effect that the state of the child's health makes postponement of the operation necessary.

Until within recent years vaccination was almost exclusively practised by arm-to-arm inoculation, lymph taken from the vesicles of one subject (usually on the eighth day) being inoculated into another subject; but the practice of inoculating directly from the calf has of late years been adopted in France, Germany, and the United States, and since 1881 the English Government has had at work an animal vaccine station in London. At this establishment in Lamb's Conduit Street a large number of vaccinations directly from the calf are now performed, and in Prussia calf lymph is said to be exclusively used. The phenomena of a successful vaccination in a healthy infant are as follows:—At the site of the insertion a small elevation develops on the second or third day. On the fifth or sixth day this papule has become a vesicle, and presents a slight central depression. The vesicle attains maturity on the eighth day, when it is full of clear lymph, and is surrounded by a circular inflamed area which extends until its diameter is from one to three inches. About the tenth day the inflammation begins to pass away, the fluid of the vesicle, which has now become opaque, begins to dry up, and a scab is formed which separates, leaving a scar, at the end of about three weeks.

The statistical evidence as to the value of vaccination is generally grouped under the following heads; in the first place, the diminution in smallpox mortality in relation to the introduction of vaccination and to the thoroughness of the way in which it is carried out at different times in various countries has to be considered. The mass of figures now available under this head affords evidence of an apparently unmistakable character, though it has been objected by some that the phenomena are explicable on the assumption that variations in the prevalence of smallpox brought about by unknown causes, or influenced by improved sanitation, would account for the coincidences observed.

The altered age incidence of smallpox in correspondence with the increasing adoption of vaccination is, however, a phenomenon which strongly corroborates the evidence under the above head, and which it is not easy for those who do not believe in the efficacy of vaccination to explain away. The table given by the Registrar-General in his 43rd annual report has been often referred

to in this connection. In the supplement to the 14th Annual Report to the Local Government Board the following statement with respect to this table is made by Sir George Buchanan, who was then Medical Officer of the Board:—"The Registrar-General, as I have said, divides the period 1847 to 1880 (during which the causes of death were abstracted in combination with ages) into portions—a first, namely, of six years (1847–53), when vaccination was optional; a second of eighteen years (1854–71), when it was obligatory but not efficiently enforced; and a third of nine years (1872–80), when it was obligatory and more efficiently enforced by vaccination officers. For England and Wales the mean annual death-rate from smallpox of children under five years old in these several periods fell from 1,617 per million, at which it stood during the period of optional vaccination, first to 817 and then to 323; and the death-rate of children between five and ten years fell in a similar way from 337 to 243 and then to 186. The rates for children between ten and fifteen years in the three successive periods of time have remained without much change, having been 94, 88, 98. At higher ages of life, to which I shall immediately recur, there has not been decrease, but increase, in the rate of death by smallpox. Nevertheless, when all ages are considered together, the average annual death-rate by smallpox, 305 per million persons living, during the period of optional vaccination, is found to have fallen to 223 during the following period of obligatory vaccination, and during the period of enforced vaccination to 156."

This alteration in the age incidence of smallpox is readily explicable when it is realised that the resistance to smallpox in adult life, which was afforded in prevaccination times by an attack of the disease in infancy, was practically complete, while it has been exchanged nowadays for the resistance furnished by vaccination, which has served to protect more especially the persons upon whom the operation has been comparatively recently performed, and has not extended the same degree of immunity to those in whom the effects of the operation have had time to become weakened. Thus, while in prevaccination times the preponderating incidence of the disease was upon childhood, among the vaccinated childhood is practically exempt, and smallpox is only fatal in later years when the protective influence of the operation has become diminished. The remarkable fact remains to be noted that among unvaccinated persons the original preferential incidence of the malady upon the earlier ages has continued to manifest itself. The other lines of argument which all point to the same conclusion may be briefly referred to. The effects of revaccination have now become abundantly evident, and it is clear that communities in which revaccination is carried out enjoy even greater immunity from the disease than those in which an original vaccination in infancy alone obtains. Prussia, in which revaccination was made compulsory in 1874, the army and navy, and the case of attendants in smallpox hospitals, are instances in point. There are, again, the elaborate statistical results of Mr. Marson and Dr. Gayton,

which show the influence exerted by the character and extent of the operation; the mortality from smallpox varying in close correspondence with the thoroughness with which the operation, designed to afford protection, has been performed. An outbreak of smallpox in Sheffield in 1887-88 was made the subject of an elaborate report by Dr. Barry, and the important evidence as to the value of vaccination afforded by the facts which he collected may be studied by those interested in the subject either in his original report or in the introduction to and summary of the report which is printed in the 18th Annual Report of the Local Government Board. Much has been written concerning the alleged risks of vaccination, but exhaustive inquiry has shown that when the operation is performed with proper care the risk is infinitesimal, and in no way capable of being weighed in the balance against the benefit which is conferred.

Vacuum means literally absolutely empty space; but the perfect realisation of this has hitherto been found to be experimentally impossible, although a point can be reached when the amount of gaseous matter left behind in a vessel is so small that it is almost unmeasurable, and is so attenuated that it has lost many of the properties usually ascribed to matter. By inverting a barometer tube carefully filled with mercury a space—known as the Torricellian vacuum—is left above a column about 30 inches high of mercury. This space, however, is not a perfect vacuum: it contains mercury vapour. Such a method of obtaining a vacuum is, however, not of great practical utility, and different sorts of air-pumps (q.v.) have been invented, the Sprengel being the one most commonly employed. The extensive use of incandescent electric lamps has caused vacua to be of considerable commercial importance, and has tended to cheapen and simplify the apparatus employed for their production. A vacuum is generally described as one of a certain fraction of an inch or of a millimetre: thus the vacuum of $\frac{1}{4500}$ inch obtained by Andrews when carbonic acid gas was removed from the receiver of his air-pump was simply one in which the pressure of the remaining gas was only sufficient to support a column of mercury $\frac{1}{4500}$ inch high. Since the initial pressure would have been about 30 inches it is seen that only about $\frac{1}{135000}$ of the original gas remained behind.

Vacuum-Pump, a pump consisting of a barrel, a suction-pipe with a valve, a discharge-pipe which has a valve, and a steam induction with a valve that is opened when the chamber is filled with water and closed when it is full of steam.

Vacuum Tubes are glass vessels containing rarefied gases, and constructed to exhibit certain electrical phenomena. Platinum wires are fused into the glass, and when the tube has been exhausted to the requisite degree it is hermetically sealed. When the platinum terminals are connected to a source of high-pressure electricity—such as an influence machine or an induction coil

[ELECTRICITY]—the tube is filled with a lambent glow, the colour of which depends, amongst other things, upon the gas with which the tube was filled previous to exhaustion, and upon the pressure of the gas. If the vacuum is very high, the discharge will not pass at all. The stream of light usually exhibits striæ—that is, is not continuous, but divided into a number of sections, separated by dark spaces. Many curious effects may be produced by discharges in very highly exhausted tubes; the discharge then proceeds in straight lines, so that it will not go round a bend in the tube, and on meeting the glass, or an object placed in its path, a bright fluorescent glow is produced, accompanied by considerable heat. Discharges may be produced by induction in exhausted tubes with no electrodes, and in some cases the fluorescent effects may be produced outside the vessel.

Vagabonds, Vagrancy. The provisions of the law with respect to vagrancy are directed against “idle and disorderly persons,” that is, persons who refuse to work, unlicensed pedlars, beggars, etc.; “rogues and vagabonds,” *i.e.* fortune-tellers, persons lodging in deserted buildings or the open air, without visible means of subsistence, etc.; “incorrigible rogues,” *i.e.* persons twice convicted of being rogues and vagabonds, persons who escape from imprisonment as rogues and vagabonds, etc. These offences are punishable with imprisonment and, in some cases, with whipping.

Valais, a canton of Switzerland, bounded N. by Berne and Vaud, S. by Piedmont, E. by Piedmont and Uri, W. by Savoy and Vaud. It has an area of 2,016 square miles, mostly comprised within the wide valley of the Rhone, and shut in by lofty mountains. Cattle-rearing is the chief industry, but the vine flourishes in parts, and the silk-worm is cultivated. Sion, Martigny, and Brieg are the chief towns.

Valencia (*Valentia Edetanorum*), a province and its capital in Spain. The former, originally a separate kingdom, has an area of 4,352 square miles, being bounded E. by the Mediterranean, N. by Castellon, S. by Alicante, and W. by New Castile and Albacete. Mountainous to the N.W., it is remarkably fertile in the lower portions, and is famous for its oranges, almonds, olives, grapes, and figs. Sheep and cattle thrive, and the silk-worm is reared in great quantities. Salt, marble, and potter's clay constitute the chief mineral resources. The Guadalaviar and the Jucar are the largest rivers. The city stands within walls on the Guadalaviar, 2 miles from the sea, and has a fair port at La Grao, and an inner harbour. It is the seat of an archbishopric, and possesses a large Gothic cathedral founded in 1262, two palaces, and an ancient university. Silk, linen, and wool are woven into various fabrics, and the pottery made here is used throughout Spain.

Valenciennes (Classic *Valentianæ*), an ancient city in the department of Nord, France, situated at the junction of the Scheldt and Ronelle, 32 miles S.E. of Lille. Founded in Roman times, it became in the Middle Ages the capital of Hainault, and has

stood many sieges. It is a first-class fortress, and the citadel planned by Vauban still exists. There is a fine town hall; and other public buildings, including churches, possess great interest. A considerable industry is carried on in linen fabrics, gauzes, merinos, and the kind of lace named after the town.

Valency. The atoms of different elements have not all the same combining value; an atom of sodium, for instance, will unite with one of chlorine to form common salt; an atom of calcium needs two atoms of chlorine to form its chloride, while one of phosphorus will combine with either three or five. Frankland, in 1672, pointed out, as a deduction from his work on organo-metallic compounds, that metals combine with a definite number of atoms, and the same law holds if, instead of "atoms," we write "radicles." Further, radicles, which can be regarded as forming a complex body by substituting one or more atoms of hydrogen in a simpler body, are also found to possess the same combining power as those atoms of hydrogen. Thus, if a radicle can replace two atoms of hydrogen, it can combine with two atoms of chlorine, just as those two atoms of hydrogen can. Hence the substituting value of an atom or radicle is the same as its combining value, and this is known as its *valency*. An atom of oxygen or sulphur will either replace or combine with two atoms of hydrogen; so oxygen and sulphur are divalent. An atom of chlorine will replace or unite with only one atom of hydrogen; so it is monovalent, while for a similar reason carbon is regarded as tetravalent. The valency of an element is, however, not a fixed property as is its atomic weight. One atom may possess the combining powers of a different number of hydrogen atoms. Thus carbon in carbon monoxide replaces only two hydrogen atoms, and may be regarded as divalent, while in marsh gas it unites with four atoms, and is therefore tetravalent. Cases of disputed valency are by no means rare; nitrogen in ammonia is undoubtedly trivalent, but in ammonium chloride it is considered by some to be pentavalent, while others regard it as trivalent, the idea of "molecular" compounds being introduced to explain this latter view.

Valens, FLAVIUS, Roman Emperor in the East, was born about 328 A.D., and was appointed emperor by his brother Valentinian, Emperor of the West. During the whole of his reign Valens was harassed by the Goths, who had obtained permission to settle in his empire. The treatment they received led to their revolt, and a long war was the consequence, culminating in the total defeat of Valens' army in 378. Valens is believed to have been killed by them, but the date is not known. He was an Arian, and the Goths adopted the same creed.

Valentinian I. (321-375 A.D.), Roman Emperor, born in Pannonia, was raised to the purple in 364, and was occupied during the whole of his reign in resisting the encroachments of the barbarians. His son, VALENTINIAN II. (371-392 A.D.), succeeded him when he was four years old. He gained victories in Italy, Illyricum, and Africa, but

was in 387 swept out of Italy by Maximus. He was restored to his kingdom later, and was murdered in 392 by Arbogastes. His grand-nephew, VALENTINIAN III. (419-455), made incessant war on the Vandals, Goths, and Huns, who succeeded in wresting territory from him. His career was practically undistinguished.

Valerian, the popular name chiefly of members of the genera *Valeriana* and *Centranthus*, belonging to the gamopetalous and epigynous order Valerianaceæ. They have perennial rhizomes, which in the British *V. officinalis* and others have a warm aromatic taste and a fetid odour, which has an intoxicating attraction for cats. The smell is apparently due to valerianic acid ($C_5H_{10}O_2$). The leaves are opposite, and the flowers small, white or red, and massed together. The calyx forms a feathery pappus in the fruit stage, and the corolla is saccate in *Valeriana*, spurred in *Centranthus*. There are three stamens in the former and one in the latter, whilst, of three carpels, two are generally suppressed, the fruit being a one-seeded cypsela and the seed exalbuminous. *V. officinalis* is cultivated near Chesterfield in Derbyshire, in Holland, and in the North-Eastern United States. Valerian is a powerful antispasmodic stimulant in cases of hysteria or epilepsy. The roots of an orchid (*Cypripedium pubescens*) are imported under the name of American Valerian.

Valetta (Italian *La Valeta*), the capital of the island of Malta, stands on a promontory between two bays on the N.E. coast, and is surrounded by strong fortifications. The site is so uneven that many streets are mere stairways, but it contains several fine buildings, *e.g.* the palace of the old Grand Masters of the Knights Templars, the cathedral, and the hospital of St. John. The town was founded in 1566 by the Grand Master Parisot de la Valetta. It was taken by Bonaparte in 1798, and wrested from him after a siege of two years by the English, who still hold it.

Valladolid (Classic *Pintia*), a province and its capital in the W. of Spain. The former has an area of about 3,000 square miles, lying between Leon and Palencia on the N. and Segovia and Avila on the S. It is mainly level, and pastures numbers of horses, mules, and cattle. The Douro, Duraton, Eresma, and Pisuerga are the chief rivers. The city stands on the left bank of the Pisuerga, about 100 miles N.W. of Madrid. Among its public buildings are the cathedral (begun by Philip II. and never finished), the noble churches of Santa Maria, San Martin, and San Benito, and the university (dating from 1346). Silk, cotton, and woollen goods, jewellery, and earthenware are the chief manufactures, and a large trade is done in agricultural produce. It was formerly the capital of Castile, and then of all Spain until 1560.

Valleys, relative depressions among hills, are of various origin. They may occasionally result from the opening of earthquake-fissures or from the falling-in of the roofs of caverns; but, however originating or determined as to their direction,

they owe their contours almost entirely to erosion by sub-aërial agents, rivers, rain, frost, etc. Where they coincide with synclinals, as in the symmetrical flexures of the Swiss Jura, such as Ballsthal, they might truly be termed *valleys of elevation*; but this term is applied, on the contrary, to such cases as the valley of the Weald or the Vale of Woolhope, which lie between the escarpments on a planed-down anticlinal. Though subterranean drainage may produce such valleys as the *chines* or *bunnies* about Bournemouth; or intermittent springs or "bournes," where the plane of saturation only rises temporarily above the surface of the ground, may originate such *dry valleys* as those in our Chalk area, most valleys are *river-valleys*. The general direction of these may be determined by lines of fault, as in that of the Jordan and perhaps in the four pairs of transverse valleys in the Weald, to wit, the Wey and the Arun, the Mole and the Adur, the Darent and the Ouse, and the Medway and the Cuckmere respectively. These eight river-valleys and those of the south of Ireland well illustrate the frequently greater antiquity of valleys than of hills or other existing surface features. The contours of valleys depend partly on the composition and structure of the rocks and partly upon the varying intensity of the various factors in erosion. Thus, as a rule, the harder the rock the narrower and steeper the valley. Joints facilitate the cutting of ravines and the formation of such buttresses and pinnacles as adorn the *dales* of Derbyshire. The passage of a river from a harder rock on to the outcrop of a softer one will commonly result in a *waterfall* (q.v.), which, as it is gradually cut back, will give rise to a *chine*, *gorge*, or *defile*; whilst conversely the passage of the river from a softer to a harder rock may cause its expansion into a *lake* (q.v.) behind the barrier, as was once the case with the Medway behind the ragstone barrier at Yalding and behind the chalk barrier at Snodland. The steeper the slope of the surface, the straighter the course of a river, the greater its velocity and vertical cutting power. Though interrupted by cascades or leaps over rocky ledges, it will consequently flow mainly in a narrow steep-sided channel. Horizontal stratification may facilitate this type of erosion, whilst a general rising of the land would certainly do so. If the rainfall of the area be deficient, the channel will be not only deep but precipitous, as are the *cañons* (q.v.) of the Colorado. On the other hand, in softer rocks or where rain is plentiful, broader valleys with sloping sides may result. Where the ground is nearly a plain, the river-course may wind excessively, the valley occupied at one time or another by the stream being of great width, as in the cases of the lower Thames or the Indus. In such windings *river-cliffs* often occur on the concave bank, but seldom on both banks simultaneously.

Vallisneria spiralis, an aquatic plant belonging to the monocotyledonous order Hydrocharidaceæ, and native to Southern Europe. It is commonly grown in freshwater aquaria in England for the sake of its long grass-like leaves. These are very transparent, and, under the microscope,

exhibit very distinctly the rotation of the cell-sap. The plant is dioecious, the male flowers, which are borne on short stalks at the bottom of the water, breaking off and floating to the surface before their stamens burst, whilst the female flower-bud is carried up on the long, rapidly-growing, spirally-coiled peduncle, from which the plant is named. The spiral coiling adapts it to variations in the water; and after fertilisation the peduncle coils up, and the fruit ripens at the bottom.

Vallum, the rampart with which the Romans enclosed their camp.

Valparaiso ("Valley of Paradise"), a province and its capital in the republic of Chili, South America. The former has an area of 1,670 square miles, and is bounded N. by Aconcagua, W. by the Pacific, S. and E. by Santiago. Though broken by mountains, the country is exceedingly fertile, and possesses valuable mines of silver and copper. The capital, founded in 1544 upon a fine bay 70 miles N. of Santiago, is the chief port of Chili. It is strongly fortified, and has a naval arsenal, building sheds, docks, and an indifferent commercial harbour. Metallic ores, wheat, chinchillas, wool, indigo, and drugs are the chief exports, whilst European goods are imported for the whole of Chili.

Valuation, the act of determining the price of any kind of property or the rent of land. This is necessary when persons become liable to probate and succession duty and similar taxes, and when a political appointment or privilege is dependent on a property qualification. In most cases, also, trustees are required to seek professional advice before advancing money on the security of land.

Value, in its economic sense, is the relation in which any one object of wealth stands to all others in regard to the amount of each which must be given when they are exchanged. All desirable things have a "value in use," but they do not acquire "value in exchange" unless there is some difficulty in obtaining them. Thus it is only under exceptional circumstances that water is valuable in the economic sense. Money being the medium of exchange, the price of a commodity is the index of its value, allowance being made for the fluctuation of the market.

Valve is a device for controlling the flow of a liquid or gas. When used in pumps, etc., it often consists of a conical hole, provided with an accurately-fitted stopper held in place by a spring or by gravity. Liquid trying to pass in one direction can raise the cone and open the valve, but pressure in the other direction keeps it more tightly closed. In another pattern a hole in a plate is provided on one side with a flap of leather or other flexible material, or in cases where great pressure is to be resisted a number of small holes are used instead of one large one. A *stop-valve*, used for controlling the supply of steam to an engine, etc., is a kind of tap, a common pattern having a cone forced upon a slating by a screw when the valve is to be closed. The throttle-valve of an engine is a somewhat similar arrangement, which is opened or closed by

the governor to adjust the speed. Such a valve is usually *balanced*, i.e. so arranged that the pressure of steam does not tend either to open or close it. [STEAM ENGINE.]

Vambéry, ARMINIUS (b. 1832), traveller and Orientalist, was born of Jewish parentage in Hungary. His parents were poor, and he was intended for a tailor, but was enabled to secure a sound education at Pressburg, Vienna, and Pesth, and became a teacher of languages. He was expelled from Pesth on account of his connection with the revolutionary movement of 1848. He went to the East, and made himself master of many of the Eastern tongues, travelling through the most inaccessible parts of Turkestan. He was made professor of Oriental languages and literature in Pesth University in 1865, and has published records of his journeys and other valuable works, philological and historical, including a *History of Bokhara* (1873), and *The Central Asian and Anglo-Russian Frontier Question* (1874).

Vampire Bat, any bat of the genera *Desmodus* and *Diphylla*, from Central and South America. The upper canines are very large, and the gullet is too small for anything solid to pass. These bats live entirely on blood, shaving off the skin of the victim, and sucking the blood from the small vessels exposed.

Vampire, in folklore, the ghost of a sorcerer, werewolf, suicide, or excommunicated person that sucks the blood of the living, and so causes them to pine away, the person thus attacked also becoming a vampire, and after death preying upon others as he himself was preyed upon.

Vanadium ($V = 51.3$). Although traces of this metallic element occur widely, and in many rocks and minerals, yet it is present to only a very small extent, and occurs in quantity in only a few rare compounds, chief among these being the mineral *vanadinite*, a vanadate of lead, and *mottramite*, a similar salt of lead and copper. Its existence was first indicated in 1801 by Del Rio, and thirty years later it was the subject of a careful research by Berzelius. The metal is obtained with difficulty, the best method being the reduction of the chloride by hydrogen. It is a silver-white metal, stable in air under ordinary temperatures. It possesses the almost unique property of uniting readily with nitrogen when heated. It forms five oxides from V_2O to V_2O_5 ; and the highest oxides give rise to an interesting series of salts, the *vanadates*, which may be regarded as derived from the hypothetical vanadic acid, H_3VO_4 , from the acid *pyroranadic acid* ($H_4V_2O_7$), which is itself unstable, and from the metavanadic acid HVO_3 , a bright golden powder. The metal forms well-characterised *chlorides* and *bromides*, but the other salts have been only incompletely studied. The vanadium compounds may be recognised by the bright-green colour given to a borax bead when heated in a reducing flame.

Vanbrugh, SIR JOHN (d. 1726), dramatist, was born in the 17th century, the year of his birth

being unknown. He was first in the army, but in 1697 appeared as a playwright, his *Relapse* being produced at Drury Lane with great success. *The Provoked Wife* followed soon after, and in 1705 his best play, *The Confederacy*, was brought out. Previous to this he had become known as an architect; Castle Howard, Blenheim Palace, and Greenwich Hospital were wholly or partially designed by him.

Vancouver Island forms part of British Columbia, lying off the W. coast of North America, from which it is separated by the Gulf of Georgia, Johnstone Strait, Queen Charlotte Sound, and the Strait of Fuca. Having a length of 275 miles, a maximum breadth of 85 miles, and an area of 16,000 square miles, it presents a deeply-indented coast-line, with Nootka and Barclay Sounds to the W., and Victoria, Esquimaux, and Nanaimo Harbours to the E. Traversed by a central ridge, 2,000 feet high, the country slopes down on either side to the sea, and has on its lower levels wooded hills enclosing rich pastures and fertile valleys. Though rivers are scarce, the climate is moist, and both wheat and vegetables grow readily. Coal is worked, and recent discoveries of gold have stimulated immigration. Fish is plentiful on the coast and in the rivers. Victoria, the capital, is at the S.E. extremity. First colonised in 1781, Vancouver Land was united with British Columbia in 1866.

Vandyck, SIR ANTHONY (1599-1641), great portrait-painter, was born at Antwerp, being the son of a wealthy merchant there. He studied under Rubens from 1615 to 1619, and in 1621 went on a visit to Italy. Previous to his departure he had executed some excellent works, earning the good opinion of Rubens, whose favourite pupil he was. In Italy he painted many fine portraits and other works, and returned in 1626 to Antwerp. His countrymen, aware of his genius, welcomed him cordially, and overwhelmed him with commissions. He came to England in 1629, but only for a short period; as he failed to attract Charles I.'s notice, he was greatly disappointed. He was specially invited to England in 1632, and was knighted by the king and appointed court painter with an annuity of £200. He painted innumerable portraits of the king and the royal family, and has also left a remarkable and unique series of historical English portraits, many of which are in the royal collections and in the national galleries. He died in Blackfriars, and was buried in St. Paul's Cathedral. He left an only daughter, his wife being Mary, daughter of Dr. Ruthven and granddaughter of the Earl of Gowrie. His portraits are notable for their ease and grace, and his management of draperies was masterly. Few painters have excelled him in the painting of the head. His portraits are a great national possession, but his historical works are also fine.

Vane, SIR HENRY (1612-62), a notable figure during the Civil War and Commonwealth periods, was of ancient lineage, and was educated at Westminster School and at Oxford. A residence abroad confirmed him in certain early republican views of his, but they were so unpopular to his friends that

he emigrated in 1635 to New England, where he became Governor of Massachusetts. He returned to England soon, however, and in 1640 entered Parliament and was knighted. He held several high offices, and in 1652 became President of the Council of State. He was a strong opponent of both Strafford and Cromwell, and was imprisoned for a time in 1656. After the Restoration he was arrested, and executed on Tower Hill in July, 1662.

Vanessa, a genus of butterflies containing the Red Admiral, Peacock, and Camberwell Beauty.

Vanilla, a small genus of climbing epiphytic orchids, natives of tropical Asia and America, of which the most important is *V. planifolia*, a native of Mexico, now largely cultivated in Guadeloupe, Mauritius, Réunion, the Seychelles, Java, etc. The pod-like fruits are from 6 to 12 inches long and half an inch in diameter, dark-brown or nearly black in colour when dry, and covered with an efflorescence or *givre* of white, needle-like crystals. These consist of *vanillin* ($C_8H_8O_3$), the aldehyde of methyl-protocatechuic acid, a fragrant substance secreted by the placentas. Mexico vanilla, which is considered the best, only yields 1·7 per cent. of vanillin; Java vanilla, 2·75. Mauritius exports about 20,000 lbs., which, with the large produce of the Seychelles, comes chiefly to London; the United States imports about 100,000 lbs. from Mexico; France, the same amount from Réunion and 5,000 lbs. from Guadeloupe; and Holland, some 5,000 lbs. from the East Indies. Vanillin can be prepared artificially from *coniferin*, which occurs in the cambium of fir-trees; it is prepared on a considerable scale in Germany from oil of cloves. It is used mainly to flavour chocolate, ices, and confectionery.

Vapour is the term applied to those gases which are easily converted into liquids. The distinction between gas and vapour is thus merely conventional; there is no real physical difference. Until the last few years oxygen, nitrogen, and a few similar substances were spoken of as "permanent" gases, but the liquefaction of oxygen is now a phenomenon with which everyone is familiar; so that this most "permanent" of gases can be considered as the vapour of the beautiful blue liquid which it yields. A substance which usually exists in solid form, such as sulphur or iodine, requires heat to melt it or render it liquid, and further heat to convert it to vapour. The boiling-points of sulphur and iodine are therefore higher than the ordinary temperature of the air, but the boiling-point of liquid oxygen is extremely low ($-180^{\circ} C.$). Hence we see that the conventional distinction between gas and vapour resolves itself into this: Vapours are produced by substances whose boiling-points are about or above the normal temperature, while gases are the vapours of substances whose boiling-points are very low. If we have a liquid in a closed space, vapour will rise from it until the pressure reaches a certain value; the vapour is then said to be *saturated*, and its pressure is called the *vapour pressure* for that temperature. So long as some liquid remains we cannot increase or diminish this pressure, which therefore depends only on the

temperature. [STEAM.] When the vapour pressure is equal to atmospheric pressure the liquid begins to boil. A vapour away from its own liquid and heated above its temperature of saturation is said to be *superheated*, and obeys the ordinary gaseous laws. [GAS.] Hence oxygen and nitrogen may be considered as superheated vapours. Many gases can be liquefied by pressure alone, as Faraday showed in the case of ammonia, etc.; and many by cold alone—*e.g.* steam; but many require both pressure and cold. For these there is a certain temperature, called the *critical temperature*, above which no pressure, however enormous, will succeed in producing one drop of liquid. There is also a corresponding critical pressure. It is worthy of note that at the critical temperature the volume of saturated vapour is equal to the volume of liquid formed from it. As a result of Andrews' experiments it has been concluded that no sharp line of distinction can be drawn between the states of liquid and vapour. At certain points it is certainly impossible to see whether a substance such as carbonic acid is liquid or gaseous, but physical tests show that at a certain point there is an abrupt change from gas to liquid. This point is on what is known as the *critical isothermal*.

Vaquero, a herdsman of the Mexican plains.

Var, a department in the S. of France, taking its name from a little river which rises in the Maritime Alps and, after a course of some sixty miles, enters the Mediterranean between Antibes and Nice. The area is 2,350 square miles, being bounded S. and S.E. by the sea, N.E. by Italy, and N. and W. by Hautes-Alpes and Bouches-du-Rhône. With a rugged surface and a dry soil, it is unsuited to wheat and cattle, but grows olives, oranges, lemons, cork, silk, fruits, early vegetables, and flowers in great abundance. Essential oils and preserved fruits form the chief manufactures. Toulon, Fréjus, Hyères, Draguignan, and Brignoles are the most important towns.

Variation, the tendency of offspring to depart from complete likeness to their parents, a tendency the converse of heredity (q.v.), was of comparatively little moment when naturalists held the Linnæan and Cuvierian view of the fixity of species (q.v.). It is true that Buffon insisted on the influence of the environment upon the organism, as did also Lamarck, in addition to his distinctive tenet of the importance of use and disuse in modifying organs. Erasmus Darwin seems even to attribute something to conscious striving on the part of the organism. Whilst Treviranus assumed indefinite variability, this was denied by Geoffroy St. Hilaire, who insisted on an action of the environment more direct than that assumed by Mr. Herbert Spencer. Thus St. Hilaire suggests that birds originated from saurians in consequence of diminution in the carbon-dioxide present in the atmosphere. It was, however, Charles Darwin's strengthening of the theory of evolution (q.v.) by the theory of natural selection that gave real importance to the study of those variations which constitute the raw material upon which natural selection has to work. Though collecting every-

thing he could as to variations in a state of nature, Darwin found his most fruitful field of observation in plants and animals under domestication, and (in addition to the general summary of all his conclusions in the *Origin of Species*) published his evidence on this class of variations *in extenso* in a separate work. He came to the conclusions—(1) that variation is largely “spontaneous,” or independent of external conditions; (2) that it is indefinite or indeterminate in direction; (3) that it is continuous, or by slight successive steps, thus postulating many generations and much time; (4) that changed habits, such as the use or disuse of organs, may produce an inherited effect—for example, as in the small wing-bones and strong legs of tame ducks; (5) that parts often vary together or in correlation—hair and teeth, for instance; (6) that domesticated organisms, being in unnatural conditions, are more variable than wild ones; and (7) that the reproductive system is peculiarly susceptible to such changes of conditions. In the discussion of the origin of species, whether by the natural selection of variations or otherwise, the underlying question of the origin of variation was largely neglected; but early critics took exception to several of these conclusions (2, 3, and 4 especially). Thus Asa Gray and Nägeli (1865) argued for definite variation along a determined line of perfectibility; and Mivart (1871) more conclusively urged that it is often discontinuous, or sudden and considerable. Fleeming Jenkin (1867) also urged that individual cases of variation would soon be swamped by crossing. Wallace has since brought forward further evidence in favour of discontinuous variation, the facts as to which have been recently summarised by Bateson (1894). Weismann has (1885) brought forward strong arguments against the transmissibility of acquired individual characters, whether the result of the environment or of habit, thus making all variation dependent upon the reproductive system. Geddes has suggested (1888) that variation is definite and dependent upon the oscillatory balance between the vegetative and reproductive functions, the predominance of the latter resulting in progress. [VARIETY.]

Varicose Veins, the condition in which veins become permanently dilated as the result of obstruction to the flow of blood through them. Varicose veins are especially apt to occur in the lower limbs, in the veins of the spermatic cord, forming a tumour in the scrotum which is known as a varicocele, and in the veins of the rectum around the anus, constituting what are known as piles. In the case of varicose veins affecting the lower limbs, the obstruction to the circulation resulting from the condition is apt to lead, under the influence of slight exciting causes, to the existence of varicose ulcer. The treatment of varicose veins is either palliative or curative. The former consists in removing as far as possible all obstructions to the circulation, and in affording external support by the use of an elastic stocking or other suitable appliance. In some instances it is, however, necessary to adopt the so-called curative method of treatment and have recourse to surgical operation.

Variegation, the admixture of different colours, especially of white, with the green of ordinary foliage-leaves, is generally of the nature of a disease. It is distinguished from chlorosis (q.v.) by being more permanent and not markedly affecting the health of the plant. It sometimes affects an entire seedling, and is supposed in some cases to be due to a deficiency of iron or potash in the soil. More often it is confined to the leaves of one branch, which exhibit this character year after year. It is propagated with most certainty by grafts or cuttings; but variegated grafts sometimes affect the stock, a variegated stock may affect a graft, the variegation is sometimes transmitted by seed, and is even said in some cases to infect merely neighbouring plants. Variegated pelargoniums, though fairly “true” when multiplied by cuttings, often bear wholly white leaves or shoots reverting to green. Variegated forms of *Euonymus latifolius*, or of the privet, frequently revert in a similar manner, shoot after shoot, especially when in luxuriant growth. The spotted *Aucuba japonica*, which is dioecious, was originally propagated entirely by cuttings, but when seedlings are grown the spots are often present, though generally in diminished numbers. Plants of variegated ivy are alleged to have infected others. Variegation generally follows the veining of the leaf, as is seen in ivies, in the “Happy Thought” geranium, and in the grass known as “Gardener’s garters.” In hollies, ivies, and other groups both yellow and white variegations occur. Variegation is probably due to the absence or modification of the chlorophyll, which, it has been suggested, may be the work of an entophytic parasitic alga or fungus. The dead-white spots on some species of *Caladium* seem to be produced by the presence of air beneath the surface of the leaf, and, like the irregular purplish blotches on our British lords-and-ladies and early purple orchis, are fairly constant throughout the species. The red spots in *Orehis maculata* are more rectangular, following the venation. Their function is unknown, but it has been suggested that they frighten field-mice away by suggesting snakes. Chemically they may consist of an oxidation-product of chlorophyll or of a distinct colouring-matter, like the red in the leaves of the *Coleus* and the beet. In floral leaves also variegation follows the veins, occurring in conspicuous blossoms and serving as honey-guides to insect visitors. The white dots in rows on the petals of many species of *Dianthus*, the finely-ruled black lines on those of *Tropaeolum* or *Viola*, and the combination of lines and splashes of more than one colour in the horse-chestnut and in the eye-bright are striking instances.

Variety, a departure from what is considered the type of a species (q.v.) in some slight particular, such as the size or colour of the flower in a plant, the size or colour-markings in a butterfly, etc. Some species are exceptionally prone to vary, the brambles presenting in this respect, for instance, a considerable contrast to their ally, the raspberry. This variability is intensified under domestication or cultivation, as in pigeons, barn-

door fowls, dahlias, chrysanthemums, etc. Flowers originating in this way are often termed "florists' flowers." Long-continued cultivation stereotypes groups of varieties into what are known as *races*; but, though the ancestry of such domesticated forms may be well known, in the case of varieties occurring in a wild state it is purely a subjective question, or matter of taste, with the individual naturalist whether they are or are not to be ranked as species.

Variola. [SMALLPOX.]

Varnishes are liquids which when painted over surfaces, as wood, metal, etc., dry to a hard, glossy coating. They are frequently used on this account to protect the material, as this coating is impervious to moisture and prevents decay, rust, etc., while they are as frequently used for decorative purposes. Varnishes should possess the qualities of hardness, toughness, sufficient elasticity to prevent cracking, and they should dry sufficiently quickly after application. They are usually prepared by dissolving resinous materials in drying-oils, spirits, turpentine, benzene, etc. Spirit varnishes dry very rapidly, and have usually a very bright and brilliant surface; they are hence chiefly employed for decorative purposes. The resin employed is usually shellac, with the addition of varying quantities of Canada balsam or mastic. The various stains and coloured varnishes employed for woodwork usually consist of such spirit varnishes to which pigments or aniline dyes have been added. Turpentine is frequently used as a solvent for the common resins, but the varnish requires the addition of some linseed, or other oil, owing to its lack of tenacity. It is often added to other varnishes to give brilliancy. The oil varnishes are usually prepared from linseed oil, though other drying oils may be employed. In these the solvent does not completely evaporate, but simply hardens and remains as a constituent of the film. Copal varnish, the most useful and best-known of the oil-varnishes, is prepared by adding together in small quantities boiling linseed oil and melted copal resin, and stirring until solution is effected, and turpentine is afterwards added. Amber may be employed instead of copal, and forms an excellent, tough, tenacious, and glossy film, but is more expensive than the commoner preparations. Mastic may be also used, but is best dissolved in turpentine or in methylated spirits. Before varnishing, woody substances should be painted over with a "size," usually a solution of isinglass or glue, so that an uniform surface is formed to receive the varnish, which would otherwise appear of a patchy consistency. The varnish employed for the Japanese lacquer is obtained from a native tree (*Rhus vernicifera*), and forms a very bright, hard, and tenacious film. [LACQUER, JAPANNING.]

Vasari, GIORGIO (1512-74), Italian painter and architect, was a pupil of Michelangelo, and executed various decorations for the Medici palaces. He was also the architect of the splendid buildings the Uffizi of Florence and the Abbazia at Arezzo. He painted several important pictures, but his fame rests very largely on his invaluable work on artists—*Vite dei Più Eccellenti Pittori, Scultori, ed*

Architetti, which appeared in 1550, and has been often reprinted.

Vaseline. After the distillation of petroleum for the preparation of the various illuminating oils, etc. [PETROLEUM], a viscid, dark brown mass is left behind in the stills. This is treated with superheated steam, and is, while still hot and liquid, decolorised by filtering through animal charcoal. On cooling, it forms the pale-yellowish, buttery substance known as vaseline. (Chemically it consists of a mixture of hydrocarbons containing from 16 to 20 atoms of carbon in the molecule. It melts at about 35° C., and decomposes if heated strongly. It is insoluble in water, but dissolves readily in benzene, turpentine, and many organic solvents. It is employed as a lubricant and also for the preparation of ointments and cerates in medicine. Mixed with small quantities of carbolic acid, it is used as an antiseptic, and (pure) is used as a substitute for cold cream and glycerine for toilet purposes.

Vasomotor Nerves, the nerves supplied to the muscular coat of the blood-vessels.

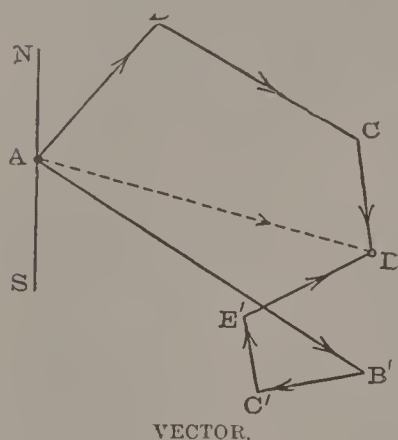
Vatican Council, the council of the Roman Catholic bishops, which promulgated the doctrine of Papal Infallibility. It met in December, 1869, and was adjourned in the following July.

Vaucluse (Classic *Vallis Clausa*), a department in the S.E. of France, taking its name from the picturesque grotto and spring which Petrarch immortalised. It has an area of 1,370 square miles, enclosed to the S. and W. by the Durance and Rhône, and to the E. and N. by the Gard and Bouches-du-Rhône. Hilly to the E., where the Alps and Mt. Ventoux intrude, it produces in other parts olives, fruits, madder, silk, wine, etc. Silk-weaving, distilling, fruit-preserving, and other trades are profitably carried on.

Vaud, a canton of Switzerland, with an area of 1,240 square miles, bounded N. by Neuchâtel, E. by Fribourg, W. by France, and S. by the Lake of Geneva. Except where the skirts of the Jura and the Alps extend, the surface is level or undulating and suited to corn and wine. Marble, coal, sulphur, iron, and asphalte are worked. Lausanne is the capital, and among the chief towns are Vevey, Bex (famous for mineral springs), Avenches, Yverdon, and Yvonand.

Vaughan, HENRY (1621-95), English poet, was a native of South Wales, and was educated at Oxford. He apparently took some part in the Civil War, and was imprisoned by the Parliamentarians, but little is known for certain about this part of his career. In 1646, being then in London, he published his first volume, *Poems*. He afterwards returned to his native place and practised as a doctor, and seems to have lived there till his death. His first poems were non-religious, which he regretted, and consequently published the fine sacred poetry, which has given him so high a rank among English poets. His later volumes of poems are *Silex Scintillans* (1650), *Mount of Olives* (1652), *Flores Solitudinis* (1654), and Part II. of *Silex Scintillans* (1655). He is sometimes called the "Silurist."

Vector is a mathematical term used to express any quantity which has magnitude and direction; it can therefore be represented by a straight line of definite length drawn in a definite direction. The line AB may be taken to indicate that we have moved from one position in space, A , to another, B . Its length indicates how far we have moved, and the angle it makes with any fixed line shows the direction. If we stated that we moved in a north-easterly direction, we should mean that the line AB should make an angle of 45° with the meridian line $N.S.$ pointing north and south. AB is hence a directed step or vector. At B another directed step, BC , may be taken, and this new vector is as rigidly defined as AB , while a third step may take us along CD to D . The arrow-heads indicate the *sense* in which the steps are taken, *i.e.* that we go



from B to C , and not in the opposite way. We might express the sum of these three steps as $AB + BC + CD$, but we must remember that we are dealing with *vector* quantities, and not mere distances in the same straight line, which would be *scalar* quantities, so that if $AB = 150$ yards, $BC = 200$ yards, and $CD = 100$ yards, the expression

$AB + BC + CD$ does not mean $150 + 200 + 100$ or 450 yards; it means that we have taken successive steps of 150 yards to the N.E., then 200 yards in a different direction, and finally 100 yards after another turn. But the point D might have been reached by the single step AD , *i.e.* by going along a "bee" line from A to D . So the result of the three steps, AB , BC , CD , is only the same as that of the one, AD . This we can express as $AB + BC + CD = AD$, still bearing in mind that we are not *adding* quantities in the usual algebraical sense. Since the goal D might have been reached by the roundabout method of the steps AB' , $B'C'$, $C'E'$, $E'D$, we can also write that the sum of the vectors representing the first series is equal to the sum of those representing the second series or $AB + BC + CD = AB' + B'C' + C'E' + E'D$, both of which are equal to the vector AD . If the steps AB , BC , CD , DA , had been taken, we should have returned to our starting-point, so that the same result would have been obtained if we had not moved at all or taken a step $= 0$. Hence we may write $AB + BC + CD + DA = 0$, but we found before that $AB + BC + CD = AD$. Hence we see that $AD + DA = 0$ or $AD = -DA$. Thus going along AD and returning again gives us a zero result, and, if we consider motion along AD to be in a *positive* direction, that along DA must be regarded as *negative*. Two vectors are obviously equal if they have the same length, direction, and sense. If, instead of taking the steps AB and BC , we took AD equal to BC in length, direction, and sense, we could then take the step DC , which is obviously—from geometrical considerations—equal

to AB in every way. Since we have reached the point C in both cases, we can write $AB + BC = AD + DC$; and since $AD = BC$ and $DC = AB$, this is the same as saying $AB + BC = BC + AB$. Hence it does not matter in what *order* we take any number of steps or carry on the addition of vectors. The laws for the multiplication and division of vectors are treated of in the branch of higher mathematics known as quaternions, and were first deduced by Sir William Hamilton.

Vedas (from an Aryan root signifying both "to see" and "to know"), the sacred books of the Brahminical religion. They are four in number—the *Rigveda*, or Veda of Praise; the *Sāmaveda*, or Veda of Chants; the *Yajurveda*, or Veda of Prayers; and the *Atharvaveda*, or Veda of the Atharvans (a priestly family). Collectively they are known as *The Veda*. Each Veda comprises two portions—the *Samhitā*, consisting of *mantras* or hymns to the gods; and the *Brahmāna*, which is a prose commentary on the *Samhitā*. Distinct from the *Brahmānas*, though closely connected with them, are the *Āranyakas* or "forest treatises," so called from their abstruse character, requiring the learner to retire to the remotest solitudes; and the *Upanishads*, which deal with the nature of the Brahman or Supreme Being. The *Sūtras*, on the other hand, are compositions of later date, laying down precise rules as to the conduct of the ritual. The Hindus regard all the Vedas as inspired; but the *Rigveda* is the most ancient, and on its *Samhitā* those of the *Sāmaveda* and the *Yajurveda* are to a great extent based. It contains $1,028$ hymns addressed to Indra, Agni, Soma, Varuna, and other deities representing natural forces which have as yet hardly assumed a personal form. The system of belief preserved in these hymns, which were probably collected about 1000 B.C., is purely Aryan. In the *Atharvaveda-Samhitā*, on the other hand, prominence is given to an evil element in Nature, which it is thought may have been due to contact with non-Aryan tribes.

Veddhas, *i.e.* "Hunters," aborigines of Ceylon, representing the Yakkos or primitive inhabitants of the island before the Aryan (Hindu) conquest; now confined to the district between Kandy and the east coast, and reduced (1891) to about $2,000$. In the interior they are still in the wild state, living on fruits, roots, and the produce of the chase; but those on the coast in the Batticaloa district are settled in villages and partly civilised. The type approaches that of the dark aborigines of the neighbouring mainland, where there are also some Veddha (hunting) groups, and the language appears to be a pure Sinhalese dialect unaffected by Sanskrit or Pali elements.

Vega is a star in the constellation Lyra. On account of the motion of the pole of the equator round that of the ecliptic, stars alter their apparent positions in the heavens [PRECESSION], and it has been calculated that in about $12,000$ years Vega will be within 5° of the equator's pole.

Vega Carpio, LOPE FELIX DE (1562-1635), Spanish dramatist of extraordinary fertility, was born at Madrid, and was brought up under his

uncle's supervision, his father having died while he was an infant. Almost from his earliest youth he could compose verse, and was a good Latin scholar in his sixth year. He studied at the Imperial College in his native city, and then joined the army, seeing service against the Portuguese in the Azores. He next was employed in the household of the Bishop of Avila, and took a degree at Alcala. Becoming secretary to the grandson of the Duke Alva, he married well, but a duel fought by him soon after led to his banishment to Valencia. His wife dying, he joined the Armada in 1588, and luckily got back to Spain, where he wrote the epic poem *The Drakontea*. He began to write for the theatre with success, and poured out innumerable verses on all conceivable subjects. In 1597 he married again, but family troubles and the death of this second wife caused him to enter holy orders, and he became a Franciscan in 1609. The leisure he obtained was devoted to continual writing, with the result that Lope de Vega Carpio is the most prolific author known to fame. Cervantes called him "The Monster of Literature," and he is said to have written twenty-one million verses. It would be quite impossible to give a list of his best works, as it is not decided which are his best, there being no Spaniard even who has read a sufficient number of his works to judge precisely. It is as a dramatist that he is chiefly known, his poems proper, with the exception of a few light and graceful songs and ballads, being either forgotten or unread.

Vegetable Ivory. [COROZO NUT.]

Vegetable Kingdom, a convenient collective term for all plants, though, since no precise dividing-line can be drawn between the lowest plants and the lowest animals, the more philosophical division of Nature is into organic and inorganic. The classification of plants (q.v.) now very generally adopted is into four sub-kingdoms, which comprise between them some ten classes, as follows:—

PHANEROGAMIA = SPERMAPHYTA.	BRYOPHYTA.
Division II. Angiospermia.	Class 4. Musci.
Class 10. Dicotyledones.	Class 3. Hepaticæ.
Class 9. Monocotyledones.	THALLOPHYTA.
Division I. Gymnospermia.	Class 2. Algæ.
Class 8. Gymnospermæ.	Class 1. Fungi.
PTERIDOPHYTA.	
Class 7. Lycopodiæ.	
Class 6. Filicinae.	
Class 5. Equisetinae.	

These sub-kingdoms and classes are all described separately, with their principal subdivisions; but botanists still differ much in the classifications they adopt.

Vegetable Marrow (*Cucurbita ovifera succada*), sometimes looked upon as a variety of the common gourd and believed to be of Persian origin, is one of our most valuable esculents. It is a trailing plant with rough, deeply-lobed leaves and egg-shaped, slightly ribbed fruit. This, though watery—it contains nearly 95 per cent. of water—is more nutritious than cucumber, containing, when in the green unripe condition in which it is eaten, 2 per cent. of sugar and some starch. The vegetable marrow is now extensively cultivated, preferring a rich moist soil.

Vegetarianism, a system of diet which consists either wholly or mainly of vegetable produce, precluding in all cases animal food which involves loss of life. Vegetarians differ considerably in the strictness of their views. Most of them now admit eggs and milk to a place, whilst a certain fanatical section object to all cooked food as unnatural. Some of the considerations which induce people to abstain from flesh have no force in the case of fish, but it would be impossible to frame a definition of the term "vegetarian" which would include fish-eaters. The Vegetarian Society was founded at Manchester in 1847. This society and numerous others, both at home and abroad, are now affiliated to the Vegetarian Federal Union, which dates from 1889. These societies have been very energetic in establishing cheap restaurants for working men in London and other large towns. Vegetarians now hold an annual international congress.

Vehmgericht, or FEHMGERICHT, an institution of mediæval Germany, ascribed to Charles the Great, but probably originating in primitive Teutonic usage. Fehmic courts (*Vehmgerichte*) were first held in Westphalia towards the close of the 12th century, and it was in that region that they reached their fullest development in the 14th and 15th centuries. In the absence of any efficient public tribunal, the emperors found them a useful organisation for checking the lawlessness of the feudal lords and their retainers. Each court exercised authority within an assigned area, meeting under the presidency of a Freigraf, who was aided by a varying number of assessors called Freischöffen. At the head of the whole organisation was the Archbishop of Cologne as Duke of Westphalia. In process of time the Vehmgericht was perverted from its original purpose and made use of by the petty princes of Germany for their own ends. It became the interest of the emperors to crush the society, and the last tribunal is said to have been that held at Celle in 1568. The courts lingered on, however, till they were finally abolished by Jerome Bonaparte in 1811.

Veins. [BLOOD. CIRCULATION OF THE BLOOD.] The structure of a vein somewhat resembles that of an artery (q.v.). The muscular fibre of veins is, however, less prominent as a constituent of their enveloping coats than is the case in arteries, and the middle coat of a vein is consequently thinner than that of an artery. Certain veins in the body, particularly those which are subject to muscular pressure, possess valves, which have an important influence in determining the direction of the flow of blood through the veins. [CIRCULATION.] (For diseases of the veins, see PHLEBITIS, THROMBOSIS, and VARICOSE VEINS.)

Veins, in mining and geology, are seams of minerals, usually metallic ores, which fill up cracks and fissures in rocks, frequently ramifying and dividing until they become narrow threads and are ultimately lost. Their thickness varies greatly from a few inches to a few feet, and the value of a metalliferous vein is always greatly increased if its thickness enables it to be easily worked. Some

veins appear to be masses extruded from within ; in other cases they are due to the deposition, in the cracks and fissures, of substances held in solution probably by water under pressure and at a high temperature.

Velasquez, DON DIEGO RODRIGUEZ DE SILVA Y (1599-1660), who is recognised as the greatest of the Spanish painters, was born at Seville, but his family was of Portuguese origin. His first master in art was Herrera, and his second Pacheco, whose daughter he married in 1620. Shortly after, Velasquez settled in Madrid, and commenced the wonderful series of portraits which has made him immortal. Philip IV., who admired greatly his portrait of Olivarez, gave him commissions, and one of these, the portrait of the monarch, is generally considered the finest specimen of portrait-painting extant. In 1629-31, after producing a number of portraits of the royal family, he went to Italy and returned with keener admiration for the Italian schools. In 1643 he was made chamberlain of the king, and lived in the palace, to which his studio had been transferred. He was again sent to Italy in 1648, with powers to purchase works of art. While in Rome he painted his fine portrait of Pope Innocent X. Honours were showered upon him by the king of Spain, and his death at Madrid in 1660 caused widespread regret. It is in Madrid that the finest works of Velasquez are to be seen, the specimens in London and elsewhere being only occasionally at his best. Apart from his great portraits, his splendid management of colour is seen in his *Forge of Vulcan*, *Crucifixion*, *Coronation of the Virgin*, *Joseph's Coat*, and *St. Anthony Visiting St. Paul*.

Vellum is the skin of calves prepared for writing by a bath of lime and repeated rubbings with a burnisher.

Velocity indicates the speed or rate of motion of a moving body. It has, however, become customary in recent years to include the idea of direction in the term "velocity," while that idea is not considered in "speed." Thus a velocity of 30 miles an hour northwards would be considered as different from one of 30 miles an hour to the east, though the speed in both cases is the same. Uniform velocity is measured as the space passed over in the unit of time, and, though we ordinarily speak of a velocity of so many miles per hour, it is more convenient mathematically to consider it as so many feet per second. In dealing with a varying velocity we cannot directly measure it in this simple way. At any moment the velocity of a train may be, say, 10 miles an hour, but it does not follow that the train actually describes 10 miles in one hour ; if it is increasing its speed, it will describe more, but what we do mean is that if the train *continued* for an hour with that velocity it would then describe 10 miles. *Average* velocity is given by dividing the total space described in any time by the number of units of time employed. A body possessing simultaneous velocities in different directions moves with a resultant velocity, which is found by an application of the parallelogram of velocities (q.v.). The reverse action to this is the resolution of a velocity into two or more component

velocities, whose combined effects are the same as that of the original. The method for accomplishing this is the same as that described in RESOLUTION OF FORCES (q.v.). When a body moves with a *varying* velocity, the rate of change of velocity is known as the acceleration (q.v.), and is positive or negative according as it tends to increase or diminish the velocity at any moment. The most common example of a body moving under a constant acceleration is that of a falling body, in which case its velocity increases every second by about 32 feet per second.

Velvet, a silken textile fabric, the pile of which is formed by passing part of the warp-thread over wires so as to make a row of loops which project from the backing, and then drawing a knife along a groove at the top of each wire, after which the latter is withdrawn. If it is desired to produce a loop pile, the cutting process is omitted. The manufacture of velvet is supposed to have been introduced from the Far East in the 13th or 14th century. Genoa has long been noted for its velvet fabrics, but Lyons and Crefeld are now the chief seats of the industry. [FUSTIAN.]

Vendée, a department in the W. of France, taking its name from a small river which rises in the Forest of Chantemarle and, after a course of 46 miles, joins the Sèvre-Mortaise. It has an area of 2,588 square miles, mostly level, and divided between the Bocage E. and centre, the Marais W. and S. to the sea, and the Plaine between the other two. The first is woody and cold, the second marshy and unhealthy, whilst the third is best adapted for agriculture. Cereals, vegetables, hemp, flax, fruits, horses, sheep, and cattle are the chief products. There are no manufacturing industries of importance, but fishing is actively carried on. Besides Napoléon-Vendée, the capital, the only towns are Fontenay-le-Comte and Sables-d'Olonne. The population is Celtic in race, and akin to the Bretons. They are devout Catholics, and were much attached to the Bourbon dynasty.

Vendetta (Italian "revenge," from Latin *vin-dicta*), the blood-feud, an institution which laid on the next-of-kin the charge of avenging his murdered relative. If the actual murderer escaped, his kinsmen might be attacked as participators in his misdeed. The *vendetta* was practised in various parts of Italy within a recent period, and is still in force to some extent in Corsica and Calabria.

Veneer, a thin slice of some costly wood which is glued to the surface of wood of a commoner kind, such as deal or pine. Articles of furniture which have been veneered appear to be made entirely of the more valuable material. The woods usually chosen are those of a hard consistency to which glue readily adheres, such as mahogany, rosewood, and the American yellow pine. Ivory may also be treated in the same manner.

Venereal Disease. [GONORRHOEA, SYPHILIS.]

Veneridæ, a family of Lamellibranchs (q.v.) or bivalve mollusca of which *Venus* is the type-genus ; this ranges from the Jurassic to the

present. The family includes some of the most beautifully-coloured and specialised of the Lamelli-branchs. *Artemis*, *Cytherea*, and *Thetis* are well-known genera belonging to the family.

Venesection. [BLEEDING.]

Venetian Red is a pigment consisting chiefly of the peroxide of iron. The natural product is a highly ferruginous earth, which was obtained from the neighbourhood of Venice; but pigments known as Venetian red generally are poorer varieties of *rouge* (q.v.) obtained by heating copperas or sulphate of iron, and consisting almost solely of the ferric oxide Fe_2O_3 . It is a useful pigment, as it possesses a bright colour, is not poisonous, and is very permanent, not fading on exposure to air and moisture.

Venetian White is a pigment which consists of a mixture of heavy spar (barium sulphate) with white lead. [LEAD.] It possesses, however, the disadvantage of the latter substance, being poisonous, and being turned black when exposed to fumes of sulphuretted hydrogen.

Venezuela, a group of thirteen states in the extreme N. of the South American continent, forming a republic, with Caracas as its capital. Until 1829 it was part of Columbia, but declared its independence, and was recognised in 1845. It has an area of about 425,000 square miles, being bounded E. by British Guiana, W. by the Confederation of Granada, N. by the Caribbean Sea, and S. by Brazil. The Eastern Cordilleras, rising to 15,000 feet, traverse it to the N., and below this the vast plain of the Orinoco stretches S. Among a thousand other rivers are the Negro, Cassiaquiare, Tuy, and Tocuyo. Large lakes fringe the coast, such as Maracaybo and Valencia, and many islands—Tortuga and Valencia the chief—are included in its territories. The soil is extremely fertile, yielding cacao, coffee, sugar, indigo, cotton, dye-woods, cinchona, fustic, and drugs. Cattle is abundant, and hides are largely exported. There are immense mineral resources, but the want of settled government checks industry.

Venice (Italian *Venezia*), an ancient city and seaport of Italy, the capital of the province which bears its name, stands at the head of the Adriatic Sea, from which it is protected by the island of Lido, a natural breakwater. Within this lies a shallow lagoon dotted with eighty islets, upon which the city is built, wooden piles serving as foundations and canals taking the place of streets. The Veneti were established here in the 4th century B.C., and became subject to Rome two hundred years later. It was not, however, until 432 A.D. that the present city sprang up. In 697 the settlers, having formed a quasi-political union, elected a doge or duke as chief magistrate. In 809 the community made itself into a republic. In the 10th century began an era of expansion and conquest. Dalmatia, Istria, the Morea, Corfu, Cephalonia, Crete, Cyprus, and many other acquisitions were made. The Crusades helped to increase the importance of the republic, and its magistrates treated on equal terms with kings and popes. All

the overland trade with India and the East was practically monopolised by the merchant princes of Venice. The discovery of the Cape route to the East and of the New Hemisphere checked and finally extinguished her prosperity. Little by little her conquests were wrested from her, and in 1797 Bonaparte seized her territories, and, giving part to Austria, incorporated the rest with the Cisalpine Republic, and the line of doges then ended with Luigi Manin. The Peace of 1814 transferred the whole to Austria, and for fifty years the Queen of the Adriatic had to submit to a foreign yoke. In 1866, by the intervention of France, Venice was finally annexed to the kingdom of Italy. The city has since then recovered some of its former prosperity. It is the headquarters of the Peninsular and Oriental Company in the Mediterranean, and of other great lines of steamers. The port has been improved, and the foreign trade is reviving. The Grand Canal is bordered by magnificent marble palaces, such as the Camerlunghi, Giustiniani, Foscari, Pisani, and Casa d'Oro. The quaint bridge of the Rialto spans it, leading to the island which was the nucleus of the early state. On one side of the great public square, the Piazza San Marco, stands the Byzantine Church of St. Mark, founded in 977. In front is the brick campanile (323 feet). From the Piazza opens out the Piazzetta, having on the E. the Palace of the Doges. Opposite is placed the Royal Palace. The Doges' Palace is connected at the back with the Piombi, once the State prison, by the famous "Bridge of Sighs." Across the water are the domes of San Giorgio Maggiore and Santa Maria della Salute, and of the other churches may be mentioned La Madonna dell' Orto, SS. Giovanni e Paolo, San Salvatore, the Redentore, and Santa Francisco della Vigna. The library in the Palazzo San Marco is one of the most valuable in Europe, and there are a large arsenal, a dockyard, and numerous public institutions. The manufactures are chiefly artistic—*e.g.* brocaded stuffs and velvets, jewellery, mirrors, iron- and bronze-work, and imitations of the antique. Great and successful efforts have been made to revive the old glass industry, and beautiful specimens of coloured ware are now produced.

Ventilation. As the continued respiration of persons vitiates the surrounding atmosphere, it becomes necessary in enclosed rooms to make provision for the renewal and constant change of the air, so that the vitiation never extends beyond a limit prejudicial to health. This renewal of the air is known as ventilation, and it is remarkable and lamentable that, although in most dwelling-houses provision is always made for the warming and lighting of rooms, scarcely ever is any adequate provision made for the equally important ventilation. The amount of fresh air required per individual per hour may be found by a simple estimation. The atmosphere contains about four parts of carbonic acid per 10,000. Expired air, however, contains a higher and almost constant percentage. The quantity of carbonic acid may therefore be employed as an index of the impurity of the air. For hospitals, etc., the quantity of this

gas should not reach above six parts per 10,000, which may be taken as the limit, and, as each person expires about 6 cubic feet of carbonic acid per hour, he vitiates to the limit of permissible impurity 3,000 cubic feet of air; and this amount of fresh air should therefore be supplied per individual per hour. Gas-burners, lamps, etc., further pollute the air, and at night-time allowance must be further made for these. It follows from the above result that the air of a small room requires complete change more frequently than that of a larger one, and hence with adequate air-supply is more liable to draughts, and owing to this large rooms are preferable from hygienic views, especially in hospitals, etc. Ventilation may be effected either by natural or artificial agencies. Natural ventilation is based upon the fact that hot air is lighter than cold, and hence ascends, while also the air vitiated by breathing or illuminating agents is always warmer than the atmosphere. Hence, if apertures be made at tops of rooms, the impure air escapes, and pure air may be drawn in from below. This, however, has the disadvantage of invariably producing draughts, and, though provision for the exit of air is well made at the tops of rooms, as by tubes above the gas-burners, valves opening into the chimney, etc., the entering air should not enter too low, but at a moderate height in the room, and should be given an upward direction, that it may slowly diffuse downward and not fall as a cascade of cold air upon the heads of the occupants. This is effected by various forms of ventilators, one of the best-known being Tobin's tubes much used in large rooms. They consist of tubes opening to the exterior air at the level of the floor and rising upward in the room to a height of three or four feet. A very simple and effective means of providing for the influx of air in ordinary rooms, bedrooms, etc., is by raising the lower window a few inches and supporting it upon a block of wood extending right across; air thus enters in an upward direction between the sashes and glass. Where no provision is made for the exit of the air, the chief agency causing ventilation is the fire, by means of which a continual current of air is kept passing up the chimney, and which drags into it the air from all over the room. Even when no fire is burning, the fireplace should not be completely closed, as it forms an invaluable aperture for the exit or entrance of air. In large warehouses, workshops, etc., artificial agencies may be employed to produce currents of air. Of these the most common are various forms of turbines or fans, by which a continuous stream of air may be kept up. They are also exceptionally useful for coal-mines and in workshops where the air is charged with small particles either of organic or inorganic matter.

Ventriculites, the members of a family of Sponges found in the Chalk. They belong to the group of Hexactinellida, and are therefore composed of siliceous material. Most of the ventriculites have cup-shaped, cylindrical, or funnel-shaped bodies, and are fixed by radiating roots. They are commonly found in flints.

Ventriloquism, the art of speaking in such a

manner that the sounds seem to proceed not from the speaker but from some other quarter. The name arose from the erroneous notion that the voice was projected from the stomach.

Venue, the county in which an action is intended to be tried, and from which the jurors are to be summoned. The plaintiff has the right to determine this, subject to rules, and, when fixed upon and determined, it is termed "laying the venue." The venue is, however, liable to be changed on good cause therefor being shown.

Venus appears to us as the most brilliant of all the planets, sometimes heralding the sun's approach in the morning and sometimes following him at night. Hence she has been called the "morning" and the "evening" star; and the ancient Greeks, believing her to be two bodies, and not one, called her Hesperus (Vesper) when she appeared at night, but Phosphorus when she preceded the dawn, this last name having been translated in the Latin Lucifer. But Copernicus explained this double function in the same way as he cleared away the curious errors regarding the motions of other celestial bodies. Venus was a planet, his theory stated, moving round the sun, and nearer than the earth to him by nearly twenty-six million miles. She thus appears to us to alternately cross in front of him and pass behind him, never reaching a distance more than $47^{\circ} 12'$ away from him. This maximum distance on either side of the sun is known as her eastern or western elongation, according to which side of the sun she appears, it being eastern when she shines as the evening star. When she passes between us and the sun—*i.e.* at inferior conjunction—she is quite dark on the face nearest to us, and is therefore invisible. When she is behind the sun—*i.e.* at superior conjunction—she has her bright face to us, and would be seen in full daylight but that her little light is completely masked by the sun's brilliancy. After this conjunction she gets more to the east of him every day, and therefore follows him as he sets. The limit is reached when she attains her elongation of about 47° , and, since the earth turns round 45° in three hours, Venus remains in view for about that time after sunset. Then the time of her visibility gets less and less as the evenings pass by, till she is lost to view, after which she comes to the west of the sun, and so shines in the morning. The time during which she is visible now increases more and more, till again she may be seen for about three hours before sunrise, after which it lessens till she reaches superior conjunction. The time taken to go through all these changes—her synodic period—is about 584 days. Since Venus shines only with light reflected from the sun, and since her orbit is within that of the earth, we should expect her to exhibit phases like the moon, and the fact that she did so was first noticed by Galileo. The moon is brightest when full, and the earth is then between the sun and moon; but Venus, when full, is beyond the sun from us, and so is completely obscured by him. She appears brightest when she is nearly in a line between us and the sun before her crescent vanishes. On account of a sort of haze which

envelops this planet, astronomers have been unable to accurately determine her period of rotation on her axis. For over two hundred years they were led to attribute to her a day only a few minutes shorter than ours, but since the observations of Schiaparelli in 1890 it has been considered more probable that her period of rotation is something like 230 days. Since she takes about $224\frac{1}{2}$ days to complete her circuit round the sun, it follows that she must turn nearly the same face to him always, resembling the moon in her behaviour to us. If this be the case, her one half enjoys perpetual day while the other freezes in continuous night. We know very little of the actual surface of Venus, for her envelope of clouds remains constantly in front of us to baffle curiosity, and never lifts to give us a glimpse of the planet beneath. These clouds send on to us the light they borrow from the sun, and shine to us with a brilliant silvery lustre interrupted here and there with shadowy markings of short duration. But when Venus shines to us in crescent-form, certain spots near the ends of the horns can be seen more definitely, and the effects of light and shadow round these points suggest that they are lofty peaks, reaching forty miles or more above the clouds. Many observations in early years seemed to indicate that Venus had a satellite or attendant moon, but the most delicate instruments of modern days have failed to produce the faintest glimpse of one, even when she is traversing the disc of the sun; so that for this and mathematical reasons the old appearances of a satellite are considered to have been illusions, or else a faint star in proximity to the planet was mistaken for an attendant.

Venus, the goddess of love, was primarily goddess of the spring among the Italians, but became identified later with the Greek Aphrodite, and is pictured rising from the sea. Her passion for Adonis and her amours with Anchises and Ares are incidents in the legends concerning her. Cyprus was generally considered the home of her worship. Her proverbial beauty has been the theme of countless artists and poets of all countries and ages.

Venus' Ear-shell, *Haliotis*, a gastropodous mollusc; the shell is striated and ear-shaped, with a small flat apex and a very wide iridescent aperture.

Venus' Flower-basket, a glass-sponge of the genus *Euplectella*, generally the species *E. aspergillum*.

Venus' Fly-Trap. [DIONÆA MUSCIPULA.]

Vera Cruz, a state of the Mexican Republic, having an area of about 27,000 square miles and a long sandy coast-line extending along the Gulfs of Mexico, Tabasco, and Chiapas. About thirty miles from the sea the land rises rapidly and becomes very mountainous, the volcano of Orizaba reaching a height of over 17,000 feet. The soil of the valleys yields coffee, cotton, sugar, tobacco, vanilla, cocoa, and all kinds of tropical produce, and on the higher levels may be found every variety of climate. Yellow fever prevails on the coast. Jalapa is the capital, and among other towns are Tuxpan, Cordoba, and Vera Cruz. The latter is a port 242 miles by railway S.E. of the city of Mexico, the entrance

being covered by the island of San Juan d'Ulloa and protected by a strong fortress. Ores, cochineal, indigo, dye-woods, drugs, etc., are largely exported, the manufactures of Europe and America being received for distribution in the interior.

Veratrum, a genus of plants containing the Hellebore.

Verbena, a small genus of herbaceous and shrubby plants, mostly natives of America, though represented by one British species, the vervain (*V. officinalis*), which gives its name to the small gamopetalous order Verbenaceæ. They have opposite exstipulate leaves; bracteate inflorescences; monosymmetric, pentamerous, and often bilabiate flowers; included didynamous stamens; and two carpels forming a four-chambered, four-seeded ovary with a terminal style. They thus differ mainly from the Labiatae in the style not being gynobasic. The teak belongs to this order. Several American species are cultivated for their gay flowers. The lemon-plant or sweet-scented verbena of our gardens, with fragrant foliage, is the allied *Aloysia citriodora*, and the volatile oil known from its perfume as *oil of verbena* is the produce of the Indian grass *Andropogon citratus*.

Verdi, GIUSEPPE (b. 1814), Italian composer, was born at Rancola, Parma, and, studying music under good teachers, produced his first opera in 1839 at La Scala, Milan. It was fairly well received, and he was encouraged to proceed. In 1843 his *I Lombardi*, and in 1844 his *Ernani*, appeared, and Verdi was henceforth one of the most popular of composers. His *Attila* and *Macbeth* did not add much to his fame, but *Rigoletto*, which, like *Ernani*, was founded on one of Victor Hugo's plays and was produced in 1851, was tremendously successful, a success enhanced by *Il Trovatore* and *La Traviata*, both appearing in 1853. Few operas are more popular than these. *Un Ballo in Maschera* (1858), *Aida* (1872), and more recently *Otello* and *Falstaff* have strengthened the claim of Verdi as the greatest of Italian operatic composers.

Verdigris consists chemically of a mixture of basic cupric acetates of variable composition, but which may be approximately represented by the formula $C_2H_3O_2 \cdot Cu \cdot OH$, and is prepared by exposing copper strips in air to the action of crude acetic acid. It has a fine green colour, and is used to some extent as a pigment, though its use is open to objection, as the compound is decidedly poisonous. It is also used, though to a small extent, for external applications in pharmaceutical preparations.

Vere, SIR FRANCIS (1554-1608), English soldier, entered the army on reaching manhood, and was sent to Holland with the Earl of Leicester's expedition in 1585, and fought bravely throughout the campaign. He afterwards went to Cadiz, and showed great prowess at Nieupoort in 1600. He defended Ostend for eight months in 1601-2, one of the most notable exploits in English history. He wrote some *Commentaries*, which were published in 1657.

Vermes, the name of the group of animals including all the worms. Its value as a distinct group is doubtful, as it does not form a definite

phylum like the Molluscs or Arthropods. It consists of thirteen classes, several of which are isolated from all the others, and no simple general diagnosis can be drawn up to include them all. Reference must therefore be made to the separate classes. These are as follows:—

1. Enteropneusta, including *Balanoglossus*, which has certain affinities to the Chordata.
2. Chaetopoda, the bristle-bearing worms, such as the Sea-mouse (*Aphrodite*) and the Earth-worm (*Lumbricus*).
3. Archi-Annelida, including some primitive forms allied to the Chaetopoda.
4. Gephyrea, including the Spoon-worms (*Sipunculus*).
5. Hirudineæ, the Leeches.
6. Rotifera, the Wheel-animals.
7. Nemertea, the Ribbon-worms.
8. Trematoda, the Flukes.
9. Cestoda, the Tape-worms.
10. Turbellaria, the Planarians.
11. Chaetognatha, comprising the small pelagic *Sagitta*.
12. Nematoda, including the Vinegar-eels, Round-worms, Guinea-worms, etc.
13. Acanthocephala, comprising the genus *Echinorhynchus*, of which the adult is parasitic in the alimentary canal of some Vertebrates.

Vermetidæ, a family of Gastropoda (q.v.), or univalve mollusca, of interest from the resemblance of the shell to many worm-tubes, such as *Serpula*. So marked is this that with fossil forms it is often difficult to know whether to assign them to the molluscs or worms. The type-genus is *Vermetus*, which dates from the Carboniferous period onward. The members of the family are all marine.

Vermiformia, a group of the animal kingdom which includes only the genus *Phoronis* (q.v.), and is allied to, or a member of, the class of Bryozoa (q.v.). *Phoronis* is a small worm-like animal, which inhabits a long leathery tube. They occur in colonies, and live around the English coasts.

Vermifuge. [ANTHELMINTICS.]

Vermilion, a valuable pigment with a fine bright colour, which consists chemically of mercury sulphide, and may be obtained from the naturally occurring compound the well-known ore cinnabar (q.v.). It is usually prepared artificially; but, as the sulphide of mercury obtained by trituration of mercury and sulphur or by the precipitation of mercuric salts is of a black colour, it has to be further treated; the best vermilion is obtained by thoroughly triturating mercury with flowers of sulphur and then heating the mass under a strong solution of potash until the desired bright tint is obtained, when the potash solution must be *immediately* washed off. Vermilion is frequently adulterated with red-lead, and is used largely as a pigment both for oils and water-colours, in the preparation of various red printing- and other inks, for sealing-wax, etc.

Vermont, one of the United States of America, having an area of 10,212 square miles, between New York W. and New Hampshire E. On either side of the Green Mountains, which traverse it from N. to S., extend large tracts of pastoral and arable land, supporting live-stock in abundance and yielding wheat and other cereals, potatoes, maple-sugar, tobacco, and very fine hard fruits. Timber is plentiful, and iron, silver-lead, copper, marble, slate, and potter's-clay are worked profitably. The

Connecticut, with its affluents, drains the E. portion, the chief rivers to the W. being the Winooski, Otter, Lamolle, and Missisquoi, falling into Lake Champlain. There are many small lakes. Montpelier (the capital), Burlington, Bennington, Woodstock, and St. Albans are the principal towns. It was the first State that was admitted to the Union in 1791, and belongs to the "New England" group.

Vernation (from the Latin *ver*, "spring"), sometimes also known as PRÆFOLIATION, is the arrangement, folding, and rolling of foliage-leaves in the bud stage. In this two points have to be noted—the arrangement of the individual leaves, and that of the leaves with reference to one another. Individually the leaves may be *plane*, or flat, as in firs; *reclinate*, or folded with the apex towards the base, as in the rare case of the tulip-tree; *conduplicate*, or folded down the midrib, the two halves together, like a sheet of note-paper, as in the oak or cherry; *pliate*, or folded like a fan, as in the beech and sycamore; *circinate*, or rolled from apex to base, like a bishop's crook, as in ferns; *convolute*, or rolled up from side to side, like a scroll, with one margin free, as in plums, arrowroot, etc.; *involute*, with the margins rolled upwards towards the upper or ventral surface, as in butterwort and violets; or *revolute*, with the margins rolled back towards the under (dorsal) surface, as in rhododendron, docks, etc. Collectively the leaves may be *valvate*, touching at their edges without overlapping, like swing-doors; *imbricate*, overlapping like roofing-tiles, as in poplars; *equitant*, where each leaf is conduplicate and overlaps with its edges those of the next in succession, as if astride of it, as in *Iris*; or *half-equitant*, where each leaf is, as it were, astride over one edge only of the next, as in sedges. However folded or rolled, leaves are generally vertical in the bud and, except when revolute, expose the under or transpiring surface. They are also frequently glutinous or hairy—all adaptations against the radiated cold of early spring.

Verne, JULES (b. 1828), French story-writer, was born at Nantes, and began his literary career by writing small pieces for the theatres. He made a brilliant success by following out the ingenious idea of writing what may be termed scientific novels, though sometimes there is little genuine science in them. They are based on a scientific fact, which is then elaborated in a most fantastic manner. There are few more popular or prolific writers, perhaps his best works being *From the Earth to the Moon*, *Twenty Thousand Leagues under the Sea*, and *To the Centre of the Earth*. But they are all strikingly readable.

Vernier is a simple mechanical device for enabling one to read the divisions of a scale much more accurately than can be done with the scale itself.

Verona, a province and its capital in North-East Italy. The former has an area of over 1,000 square miles, bounded by the Mincio and Lake of Garda to the W., Vicenza to the E., and the Tyrol to the N. It is traversed by the Adige, and, though mountainous in the N. and marshy in the S., pastures

many cattle and grows corn, vines, mulberry-trees, and fruits. The capital, situated on the Adige, 62 miles W. of Venice, was colonised by Julius Cæsar, and is one of the most interesting cities to the archæologist. It is walled, and possesses strong modern fortifications, being one of the fortresses that form the Quadrilateral. The cathedral, rebuilt in the 12th century, the church of St. Zeno, a Byzantine structure of the 9th century, Santa Anastasia, and San Stefano are among its ecclesiastical glories. The well-preserved amphitheatre, the Porta dei Borsari, and other remains recall the Roman period. The tombs of the Scaligers, the palaces of the Moneschalchi and the Bishops, the Gran Guardia, and the Consiglio bear witness to mediæval taste and grandeur. Considerable industries exist, dyeing and the making of silks, velvets, and woollen fabrics being the most important. A large trade is carried on in local produce.

Veronese (1530-88), painter, was born at Verona, and was called after that place, his real name being PAOLO CAGLIARI. After completing his art studies under his uncle, he received a commission to decorate Mantua Cathedral, for which his *Temptation of St. Anthony* was painted. In 1555 he proceeded to Venice, and there formed one of the great trio of Titian, Tintoretto, and Veronese. He executed some magnificent works for the Venetian churches, works like his superb *Marriage at Cana* and *The Story of Esther*. Most of his works describe Scriptural scenes, especially those relating to the life of Christ. The National Gallery has several fine specimens of his work.

Veronica, a genus of scrophulariaceous plants comprising about 160 species of herbs and shrubs, mostly belonging to the North Temperate zone, but represented in Australasia. There are fifteen small British species, and several others are cultivated as hardy border-plants. They have opposite or whorled leaves, racemose inflorescences, sub-rotate corollas, two diverging stamens, and flattened, two-chambered, few-seeded capsules. Two of the five sepals and two of the petals are so fused as to appear in each case like four, but of the resulting four corolla-lobes the posterior is generally larger and the anterior smaller than the two lateral ones. The English species are known as speedwells. The flowers are blue, lavender, violet, or white.

Versailles, the capital of the department of Seine-et-Oise, France, is a handsome and regularly-planned city, about 10 miles S.W. of Paris, affording an agreeable suburban retreat to the inhabitants of the capital. Until 1666 it was a mere village, but Louis XIV. built here the famous palace, for many years the chief residence of the French Court, and laid out the splendid gardens and picturesque park. The building was designed by Lebau in the Renaissance style associated with the name of Mansard, and contains gorgeous suites of apartments and galleries, now used as a national museum of historical art. The terrace overlooks the well-known fountains, beyond which stretch the avenues of the park. Two minor palaces, the Great and the Little Trianon, the latter erected for the use of Marie

Antoinette, stand a short distance away, and in the town is the historic Tennis Court, the cradle of the French Revolution. Except on the rare occasions when a National Assembly is held, the palace of Versailles serves only as a museum. It was last inhabited by William I. of Germany and his suite in 1870-71.

Vertebrates, VERTEBRATA, one of the main divisions of the animal kingdom, containing those forms which possess a backbone. By some writers the term is limited to the Craniata or True Vertebrates, while others use it to denote all the Chordata (q.v.). In the former case Amphioxus and the Hags and Lampreys are excluded; the classification then is:—

Cyclostomata (Hags and Lampreys).	
Pisces (Fishes)	} Ichthyopsida.
Amphibia (Frogs and Toads)	
Reptilia (Snakes, Lizards, Crocodiles, Tortoises)	} Sauropsida.
Aves (Birds)	
Mammalia (Mammals).	

Verticillaster, or FALSE WHORL, two glomerules, or sessile, cymose clusters, generally in the axils of a pair of opposite leaves, forming together an apparent whorl of flowers round the stem. It occurs commonly among Labiatæ, where sometimes a number of these verticillasters succeed one another in a spicate or capitulate manner, as, for example, in the mints.

Vespasianus, TITUS FLAVIUS SABINUS (9-79 A.D.), Roman Emperor, was born in the Sabine country, and was of humble parentage. By his valour he attained to high rank in the army, and in the year 51 became consul. He was named proconsul in Africa by Nero. After Vitellius had reached the throne, Vespasian opposed him, and, backed by powerful military influence, put Vitellius to death and seized the throne in 69 A.D. He carried on extensive wars in Germany, Britain, and Jerusalem, but his chief claim to remembrance is his building of the famous Temple of Peace and the Colosseum.

Vespertilionine Alliance, one of the two groups into which the sub-order Microchiroptera is divided. The tail is contained within the membrane between the thighs. [BAT, 2.]

Vespucci, AMERIGO (1451-1516), navigator, was born in Florence, and is famous as having made a voyage in 1499 to the south coast of America, which is named after him. He made a second voyage afterwards, and printed an account in Latin of his journeys (1507). He was undoubtedly inclined to exaggerate and is said to have misrepresented the date of his visit to America. He succeeded Columbus as chief pilot of Spain in 1505.

Vesta, a goddess of light, whose special function it was to watch over the fire of the household hearth. The Greeks called her Hestia, and she was always personified as a virgin and as an emblem of purity. To keep a fire constantly burning in the towns was regarded as a necessary tribute to her. In Rome, where it was believed the sacred fire came from Troy, it was kept burning in a temple in the Forum, and was tended by six

priestesses, who bore the name of vestals, as they were obliged to be virgins, and were punished, if they broke their vows, by being buried alive. While vestals they were held in the greatest honour. Vesta's festival was the 9th of June.

Vestments, the garments worn by the officiating clergy during public worship. It is now generally agreed that the vestments adopted by the Christian Church originated in the ordinary garb of Roman citizens. Thus, of the three vestments mentioned at the Fourth Council of Toledo (633), the alb (q.v.) has been identified with the Roman tunic, the *planeta* or chasuble (q.v.) with the toga, and the *orarium* or stole (q.v.) with a garment worn by Roman matrons. These remained unaltered in the services of the Church, whereas in daily life they disappeared or became modified owing to changes of fashion.

Vesuvius, an active volcano on the E. shore of the Gulf of Naples and about 10 miles S.E. of the city. The base of the mountain is about 30 miles in circumference, and the height at present 4,000 feet, but eruptions alter the elevation. A funicular railway now leads to the edge of the crater, which has a diameter of half a mile and a depth of 350 feet. The first recorded eruption was that of 79 A.D. which engulfed Herculaneum and Pompeii and caused a loss of perhaps 200,000 lives, Pliny the Elder being a victim. Sixty movements of greater or less violence have since ensued, of which the chief dates are 1631, 1759, 1767, 1794, 1822, 1855, 1861, 1865, 1868, 1872, 1878-79, 1885, and 1891.

Vetch (*Vicia sativa*), an annual leguminous plant, with pinnate leaves ending in tendrils, subsessile axillary, pea-like, pale-purple flowers, solitary or occasionally in pairs, and silky linear pods one to three inches long, containing from four to ten seeds. It is extensively grown as a green fodder plant, some 400,000 acres being annually sown in the United Kingdom.

Veto, a political term denoting—(1) the constitutional power possessed by one branch of the government of preventing measures passed by another branch from becoming law, or of refusing its sanction to some administrative act; (2) the right of a single member of a legislative body to cause the rejection of any proposal by his adverse vote. The right of veto, the sole legislative function which still appertains to the British sovereign, has not been exercised since 1707. The President of the United States possesses only a qualified veto, for his decision may be overridden by that of a two-thirds majority of both Houses of Congress. The most striking example of the second kind of veto was the Polish *Liberum Veto*, entitling any deputy to the Imperial Diet to prevent further discussion on a matter by uttering the words *Nie pozwalam* ("I do not permit it").

Vibracula, certain zooids in a colony of Bryozoa modified into the form of long whip-like cords. They are flexible, and serve either to remove foreign bodies or for purposes of defence; in the few free Bryozoa they also serve for locomotion. In their simplest whip-like type they may be

seen in the Common Sea-mat or *Flustra*; their highest development is met with in such forms as *Lunulites* or *Biselenaria*, which are free.

Vicar (Latin *vicarius*, "deputy"), in ecclesiastical law, denotes the priest of a parish the tithes of which are appropriated or impropriated. [IMPROPRIATION.]

Vicenza (Classic *Vicentia*), a province and its capital in North-East Italy. The former has an area of about 1,000 square miles, bordering on the Tyrol, broken by the spurs of the Alps, and drained by the Brenta and Bacchiglione. Timber, coal, silk, and agricultural produce are the chief resources. The city stands on the Bacchiglione, 37 miles N.W. of Venice, and possesses a cathedral, triumphal arch, and several fine palaces designed by Palladio, a native of the place. Woollen and silken fabrics, jewellery, and wooden wares are extensively manufactured, and there is a good market.

Victor-Emmanuel II. (1820-78), King of Sardinia and subsequently of Italy, was born at Turin, and became king in 1849. He had taken part in the revolution of 1848 and in the war against Austria, and with the aid of Cavour suppressed the small revolts of Sardinia. In the war of 1859, when he gained Austrian Lombardy, but lost Nice and Savoy, and when Tuscany afterwards yielded to him, he showed much personal bravery. Later Garibaldi added Naples and Sicily to his possessions. In 1861 he was proclaimed King of Italy. In September, 1870, he entered Rome, the capital of the Papal States, and annexed them, the temporal power of the Popes being destroyed at a blow and the unification of Italy rendered complete.

Victoria, a colony of Great Britain in the S.E. of Australia, lies S. of New South Wales, from which it was separated in 1851, and E. of South Australia. Originally settled as Port Philip in 1834, it soon developed into a thriving pastoral and agricultural community, when in 1851 the discovery of gold caused an enormous influx of population and brought in the course of the next generation some two hundred millions of money into the country apart from capital introduced by settlers. Melbourne, its capital, soon rivalled the great cities of Europe in size and splendour, railways were opened up, commerce of all kinds received a startling impulse, nor did education, religion, and political institutions languish. When the gold fever passed away (though mining still employs many thousands of hands), a solid basis of prosperity had been built up. The wool trade had grown to over five millions a year; wheat was exported to the value of a million and a half; whilst live-stock had increased tenfold. Latterly the production of wine, silk, fruits, and even butter, for the European markets has steadily advanced, and the trade in frozen meat has reached large proportions. The area of Victoria is 87,884 square miles, most of which is undulating and less monotonous than other parts of the continent. The highest ground is in the W., where the Grampians attain a height of from 4,000 to 5,000 feet. Towards the E. the Australian Alps rise here and there to greater

altitudes, and are the source of the Murray River, which with its tributaries drains all the colony except Gippsland. Water is, however, scarce in certain districts. The climate is remarkably healthy, ice and snow being almost unknown. Gippsland possesses coal deposits of value, and, besides gold, most of the other metals are found in workable quantities.

Victoria (ALEXANDRINA VICTORIA), (b. 1819), Queen of Great Britain and Empress of India, is the only child of the late Duke of Kent, fourth son of George III., and the Princess Victoria Maria Louisa (1786-1861), daughter of Francis, Duke of Saxe-Coburg. The Duke of Kent died in 1820, and the education of the princess was directed, under her mother's care, by the Duchess of Northumberland, wife of the third duke. She succeeded her uncle, William IV., on June 21, 1837, and was married on February 10, 1840, to the late Prince Albert (q.v.) of Saxe-Coburg-Gotha, who died December 14, 1861. In 1876 Her Majesty assumed the title of Empress of India.

Victoria Cross, a naval and military decoration instituted by Queen Victoria in 1856 as a reward for conspicuous bravery in the presence of the enemy. It is a bronze Maltese cross, with a royal crown surmounted by a lion in the centre, and underneath a scroll with the inscription "For valour." The ribbon is red for the army, blue for the navy.

Victoria Nyanza, a lake in Central Africa traversed by the equator and lying E. of long. 31° 40' E. It was discovered in 1858 by Speke, who explored it in company with Grant four years later, Stanley effecting the circumnavigation in 1875. It has a length of about 300 and a breadth of 90 miles, with an area of over 20,000 square miles. The White Nile issues from its N. extremity by Napoleon Channel and Ripon Falls, and flows thence to Albert Nyanza (q.v.), about 80 miles to the N.W. The territory of Uganda, now the scene of the operations of the British East Africa Company, lies between the two lakes.

Victoria regia, a magnificent water-lily inhabiting the north-eastern rivers of South America, which has been grown successfully for some years in English conservatories. It has a fleshy rhizome, petioles armed with remarkable prickles, and peltate floating leaves, six to twelve feet across, turned up all round from one to three inches above the water. The veins are prominent on the lower surface and spinous, as is also the calyx. There are four reddish, deciduous sepals; numerous, multi-seriate, white and rose-colour petals and stamens, the innermost of the latter being sterile; and a cup-like ovary with projecting, radiating stigmas and many-seeded chambers. The fruit is prickly, and ripens at the bottom of the water.

Victoria University. [OWENS COLLEGE.]

Victualling. The victualling department of Her Majesty's navy has since 1869 been under the control of a civil official at the Admiralty. The great victualling yard at Deptford supplies those at Portsmouth and Devonport as well as the depôts abroad. The victualling stores comprise food,

clothing, soap, and tobacco. Rations (for which in some cases a sum of money may be substituted) are issued to all officers and men on full pay, under the superintendence of the paymaster. Men on board merchant-ships are victualled in accordance with the Merchant Shipping Act.

Vicuña (*Auchenia vicugna*), the smallest of the genus *Auchenia*, standing about 30 inches at the shoulder. The wool is light-brown, fading into white on the under-surface. It is a native of the highlands of Bolivia and Chili, and is hunted for its wool and flesh. [ALPACA.]

Vienna (Classic *Vindobona*, German *Wien*), the capital of the Austrian Empire, stands on the right bank of a loop of the Danube, at the foot of the Wiener Wald, an offshoot of the Styrian Alps. The old or inner city, once walled or fortified, is now connected with the surrounding suburbs by extensive boulevards, occupying the space known as the Ring. Within its area are the Hofburg or Imperial Palace, the noble Gothic cathedral of St. Stephen, the public offices, and the university. Here the streets are narrow, but the newer quarters are laid out with regularity and splendour, magnificent houses and fine public and private gardens being everywhere met with. To the S.W. lies Schonbrunn, the summer palace of the Emperor, amidst gardens of great beauty. Tramways connect all parts of the city, and railways provide communication with Paris, Berlin, Constantinople, and Italy. The Danube is navigable for steamers of moderate draught, upwards to Ulm and downwards to the Black Sea. Originally the headquarters of a Roman legion, Vienna was incorporated by Charlemagne in his dominions, and in later days for some centuries stemmed the inroads of the Turks. Occupied by Napoleon in 1805 and 1809, it became in 1814 and 1815 the seat of the famous Congress which sought to undo the great conqueror's work.

Vienne. 1. A department of France, taking its name from a river which rises in the department of Corrèze, and, passing Limoges, Châtelleraut, and Chinon, joins the Loire after a course of 190 miles. It has an area of 2,691 square miles, and is for the most part level, producing cereals of all kinds, a little maize, flax, hemp, and chestnuts. Horses, mules, and sheep are bred in large numbers. Iron is found and worked into cutlery and arms at Châtelleraut, and lithographic stones form a valuable product. There are factories for hempen and linen goods. Poitiers is the capital, and most of the old province of Poitou is included in the department.

2. VIENNE (classic *Vienna Allobrogum*), one of the most ancient towns of France, situated on the left bank of the Rhône, where the Gers joins it, about 45 miles N.W. of Grenoble. It was the capital of the Allobroges, and under the Roman emperors became the centre of the Viennensis. In the 5th century it was the capital of Burgundy, and was not finally annexed by France until 1448. A general council was held here in 1311, and the Knights Templars were suppressed. There are remains of an amphitheatre, of a triumphal arch, a

temple to Augustus, and other interesting antiquities. The Gothic cathedral dates from 1245. The smelting of iron and lead and the making of ropes and yarn are the chief industries, but there is a large trade in the wine known as Côte-Rotie.

Vienne, HAUTE, a department of France, occupying an area of 2,130 square miles, mostly carved out of the old province of Limousin, Limoges being the capital. The outlying ranges of the Auvergne Mountains spread into the central and southern portions, and contain iron, lead, tin, antimony, marbles of various qualities, and an abundance of porcelain clay. The soil is too poor and the climate too moist for successful agriculture, and chestnuts supply the food of the bulk of the population. Hemp, flax, and vegetables are grown, and the pastures maintain a fine breed of horses and many sheep.

Vigfusson, GUDBRAND (1827-89), Icelandic scholar, was born in Iceland and educated at Copenhagen. He came to England in 1864, and in 1884 was appointed Icelandic reader at Oxford. His *magnum opus* was the completed edition of Cleasby's *Icelandic Dictionary* (1873), which, in its present form, is mainly his work. He also brought out the *Corpus Poeticum Boreale* (1883), in conjunction with F. York Powell, furnished the valuable introduction to the *Sturlunga Saga* (Oxford, 1878), and edited various other sagas.

Vilela, a South American people formerly powerful in the Gran Chaco region, Argentina. Jointly with the kindred and allied Lule nation, they occupied most of the territory about the Upper Salado basin as far north as the Rio Vermejo, in the present state of San Juan. Both branches of the family have now nearly disappeared, either exterminated during the long frontier wars or absorbed in the surrounding Argentine populations. In the old *huacas* (burial-places) are found those remarkable sepulchral urns, nearly all containing the remains of children who are supposed to have been sacrificed to the gods to obtain good harvests or victory over their enemies. (Lafone, Quevedo.)

Village Communities. The theory that the primitive form of agriculture was the joint cultivation of lands held in common by a free tribe was first promulgated by G. L. von Maurer in 1854. Communities certainly exist, or have existed, throughout the world whose system of cultivation might be explained by this hypothesis, the Russian *mir* being their best type, though instances are numerous both in Europe and Asia. A redistribution of the land into new lots took place at intervals of a few years, the rotation of crops being prescribed by the village council in accordance with immemorial custom. Traces of the three-field system, by which the whole mark was divided into three strips, one of which lay fallow, while on either of the others a different crop was raised, abounded in England within a recent period, and even now are not quite extinct. One of the most curious features of the mark is that the plots belonging to a single family were scattered about indiscriminately among the three strips. The mark system was universal in

the Middle Ages, and, in spite of the growth of large farms, prevailed in England up to the middle of the 18th century. Seebohm, Fustel de Coulanges, and later critics of Von Maurer and Maine, trace back the mark, not to a free village community, which they regard as mythical, but to an organisation of free lords and servile tenants like that maintained in the feudal system.

Villars, CHARLES LOUIS HECTOR, DUC DE (1653-1734), French general, was born at Moulins. In his youth he served under Louis XIV. in Holland and under Condé and Turenne in Germany. As ambassador at Vienna (1699-1701) he was very successful in upholding French interests. Sent to aid the Elector of Bavaria, who had joined France in the War of Succession (1702), he gained several important advantages, but the Elector's timidity prevented his projected march on Vienna. In his suppression of the rising of the Camisards (q.v.), his humanity was no less conspicuous than his military skill. In 1705 he prevented Marlborough from crossing the N.E. frontier and conducted a successful campaign in Alsace. In 1709 he was defeated by Marlborough at Malplaquet, receiving wounds which disabled him for two years. His brilliant successes against the allies in 1712 restored the fallen fortunes of the French, who were able to negotiate the Treaty of Utrecht (1713) and the Peace of Rastadt (1714). He now became very powerful at Court, but in 1732 he withdrew from public affairs, owing to the opposition of Fleury. In the War of the Austrian Succession (1733) he commanded for a short time in Italy.

Villeneuve, PIERRE CHARLES SYLVESTRE DE (1763-1806), French admiral, was born at Valensoles, and entered the navy in his fifteenth year. Placed in command of the Toulon squadron in 1805, he succeeded in luring Nelson across the Atlantic, but did not thereby effect his plan of releasing the French fleets blockaded at Ferrol and Brest. On his return to European waters he defeated Napoleon's purpose of invading England by putting into Cadiz, where he was blockaded by Nelson. Full of chagrin, he left Cadiz on October 19, and two days later met Nelson off Cape Trafalgar. After his defeat in that battle he remained a prisoner in England till April, 1806, and on his return to France committed suicide at Rennes.

Villi, numerous minute vascular projections from the mucous membrane of the intestine.

Villiers, CHARLES PELHAM (b. 1802), brother of the fourth Earl of Clarendon, was educated at Haileybury and Cambridge, and was called to the Bar in 1827. He was returned for Wolverhampton in the Free Trade interest in 1835, and has always continued to represent that town. His annual motion in favour of Free Trade was repeated until it was established. As President of the Poor Law Board (1859-66) he gave practical application to the doctrines of Adam Smith and Malthus.

Villon, FRANÇOIS' (1431-8-), a French poet whose real name is uncertain. According to his own account, he assumed that of an ecclesiastical patron, Guillaume de Villon. Our knowledge of his

life is derived mainly from allusions in his own writings. He appears to have passed a wild, reckless youth, and, after his student days were over, to have been confirmed in his evil courses by the murder of a priest in a street broil (1455). Burglary was his special delight, and he was more than once condemned to death and pardoned. At the age of thirty he was already broken down by dissipation and the rigour of his life in prison. His *Petit Testament* (1456) and *Grand Testament* (1461) are written in stanzas of eight lines, each of which is octosyllabic.

Vincent de Paul (1576–1660), one of the most eminent saints of the modern Roman Catholic Church, was born at Poiry, near Dax, in Gascony. Through the Count of Joigny, in whose family he had been tutor, he became in 1619 Almoner-General of the Galleys, and devoted himself with wonderful success to the reformation of the criminals with whom he was brought into contact. In 1625 he set on foot the Congregation of Priests of the Mission, or Lazarists (so called from their establishment at the Priory of St. Lazare in Paris), a society designed to carry on missions in country districts and foreign countries and to train young priests. He also established two foundling hospitals at Paris and instituted the Society of St. Borromeo, the Filles de la Charité, and other religious and charitable organisations. He died at St. Lazare. The Society of Vincent de Paul, a widespread association for the relief and aid of the poor, was founded in 1833.

Vincentines, the members of the Society of Vincent de St. Paul.

Vine, the numerous species of the genus *Vitis*, the type of the polypetalous order Vitaceæ, of which *V. vinifera*, a native of Armenia, cultivated from immemorial antiquity in the Old World, is the chief, though four out of the ten North American species are also cultivated. They are woody, quick-growing plants, with scattered, palmately lobed, stipulate leaves and branched tendrils. The inflorescence is a compound raceme of small, fragrant, greenish flowers, tetramerous or pentamerous and isostemonous. The petals cohere by their tips and fall off in little stars. The superior ovary is two-chambered and four-ovuled; but the nuculane resulting from it has, by abortion, generally only two seeds, whilst the cultivated varieties from which the sultana raisins (q.v.) and currants (q.v.) are obtained are seedless. Grape-stones are found in Swiss lake-dwellings of the Bronze Age, and in Egyptian mummies earlier than 1000 B.C. Besides the record of the making of wine by Noah, we have mention of it in Homer and of numerous varieties of grape in Virgil. It was probably introduced into France at the founding of Marseilles, about 540 B.C., and to the banks of the Rhine and to Britain by Roman agency. Tacitus' statement that our climate was unsuitable to the vine implies an attempt at its culture, and vineyards are commonly mentioned in Early English records; but it is suggested that honey was added to make up for the want of sun to develop the sugar in the fruit. The limits of the successful cultivation of the vine lie

between 36° and 48° N. latitude (the northern limit being the southern extension of sugar-beet cultivation) and a similar zone in the southern hemisphere, the requisite summer temperature being about 67° F. The vine is, however, very amenable to artificial heat, its fruit being procurable in vineries at any season and almost in any country. From it we obtain fresh fruit, the dried raisins and currants just mentioned, wine, vinegar, and brandy. Like other domesticated plants, the vine is subject to many destructive diseases. Over thirty insects attack it, of which by far the worst is the North American aphid (*Phylloxera vastatrix*), which was first detected in France in 1868, the injury being done by sap-sucking parthenogenetic females which infest the root. Grafting American species of vine on European ones, or *vice versa*, has been tried as a preventive, but its chief result is to deteriorate the vine. The most successful treatment is a periodical submersion of the vineyards for six weeks at a time. Among various parasitic fungi that attack the vine the most destructive are the pyrenomycetous *Erysiphe* (*Oidium*) *Tuckeri*, *Sphaceloma ampelinum*, and *Physalospora Bidwellii*. The *Erysiphe*, introduced from America about 1845, first attacks the young leaves. Flowers of sulphur is the most effective remedy. *Sphaceloma*, known as *anthracnose*, *charbon*, *pech*, or *brenner*, may be of Old World origin. It is treated with copper sulphate. *Physalospora* or *black rot*, which is similarly treated, is also apparently American.

Vinegar is a crude form of acetic acid obtained by the acetic fermentation of alcoholic liquors. It has been known from early times, and was an important reagent of the earlier alchemists. The acid obtained by the distillation of wood consists also of a crude acetic acid, but is known as pyroligneous acid, the term "vinegar" being usually restricted to the product obtained from alcohol. Various alcoholic liquors may be employed for its preparation, and the flavour, etc., of the final product varies with the liquor used. Wine, diluted spirits, or beer are commonly employed, and are exposed to the air in vats, the temperature being kept at about 75° F. The time required for the fermentation varies, but may be taken as usually two to three weeks, and is hastened by allowing the liquor to trickle over beechwood shavings into vats below, and it is finally filtered and clarified. In this country beer is chiefly used, and the product is known as malt vinegar. In France wine is commonly employed, white wines especially yielding a pure product. The strength of vinegar is usually estimated by the number of grains of sodium carbonate required to neutralise a fluid ounce. It is very largely employed in pickling, for culinary purposes, as a condiment, in stimulating perfumes, and also in pharmacy as an external stimulant.

Viol, a stringed musical instrument of the same type as the violin, which received its most characteristic form in the course of the 15th century. It bore a general resemblance to the guitar and the lute; but, unlike these instruments, it was played with a bow. Its chief features were a flat back, from five to seven strings tuned by fourths

and thirds, a wide slender neck, and curves in the sides larger than those of the violin.

Viola, the tenor violin, somewhat larger than the ordinary violin. It has four gut strings, tuned in fifths, thus: A, D, G, and C, the two lower strings being covered with silvered copper wire. Music for this instrument is commonly written in the *alto clef*.

Violet, the popular name for many species of the genus *Viola* which gives its name to the thalamifloral order Violaceæ. There are in all about a hundred species of *Viola*, mostly natives of temperate regions, about a dozen being British; but this includes the pansies, which are not generally termed violets. The violets have rhizomes containing an emetic principle. They seldom reach the dimensions of undershrubs. The leaves are simple, stipulate, and involute, and the flowers characteristically monosymmetric. The five sepals are auricled at the base: the lower of the five petals is spurred: the five stamens have very short filaments, connate introrse linear anthers, and broad appendiculate connectives, those of the two anterior ones having a tail-like nectar-secreting appendage enclosed within the corolla spur. The ovary is made up of three carpels, one-chambered, with numerous anatropous ovules on parietal placentas and a terminal style, dilated above; and the fruit is a three-valved capsule with albuminous seeds. Many of the species have cleistogene (q.v.) flowers, as well as the conspicuous (chasmogamous) ones, the former producing most seed. The petals of the latter are commonly marked by finely-ruled honey-guides. *Viola odorata*, the sweet violet, is British, but is largely cultivated under many forms. Reddish, white, and purple varieties occur wild, and the large, pale, double Neapolitan violet is merely a cultivated form. The sweet violet is the emblem of the Napoleonic dynasty. Scentless wild species are known as *dog violets*.

Violin (Italian *violino*, diminutive of *viola*, "a viol"), the chief modern representative of the stringed instruments played with a bow. It consists of a hollow wooden chest, with curved belly and back, joined by sides or ribs, each of which has a peculiar indentation or bent half-way in the length; a neck or finger-board, extending some distance down the belly; and four strings attached to a tail-piece at the bottom of the chest and kept in position and tune by pegs or turning-pins at the upper extremity of the neck. Rather more than half-way down the belly the strings are raised by a bridge of convex outline, so that the bow comes into contact with each separately without disturbing the others. A sound-post between back and belly gives support to the bridge at the point of greatest tension. On the surface of the belly, on either side of the bridge, there are two sound-holes of the form *f* or *∫*. The strings, which are of gut, the lowest being covered with silvered copper wire, are tuned in fifths, thus: E, A, D, and G (next below middle C). Whilst playing the violinist keeps his instrument in a nearly horizontal position by means of the left arm, the lower part of the

chest resting on his left collar-bone. The bow, which is made of horsehair charged with rosin, is held in the right hand. The compass is raised through eleven different positions from two octaves and a major third to nearly four octaves. The pitch of the tones is regulated by "stopping" the strings—*i.e.* pressing them with the fingers of the left hand against the finger-board, so as to shorten the vibrating portion. Harmonies are produced by touching the strings lightly. Owing to its wide range of expression, the violin is the most important instrument in the modern orchestra. Violins were first constructed by the Milanese in the latter part of the 16th century. The form of the instrument was finally determined a hundred years later by Antonio Stradivari (1649–1737), of Cremona.

Violoncello (diminutive of Italian *violone*, the augmentative of *viola*), an instrument of the viol class, held by the player between his knees. It occupies an intermediate position between the viola and the double-bass. Its size is about twice that of the violin. There are four gut strings, tuned in fifths, thus: A, D, G, C, the third and fourth being covered with silvered copper wire.

Viper, any individual of the genus *Vipera* (= *Pelias*), type of a family (Viperidæ) of venomous snakes widely distributed in the Eastern Hemisphere and most abundant in Africa. The head is broad, and the tail short as compared with the body. There is a large, perforated, erectile fang in each jaw, with others in reserve behind. The Common *Vipera* (*V. berus*), the only British venomous reptile, is more abundant in Scotland than in England. It is doubtful if its bite has ever proved fatal to an adult in good health, though children and persons of weak constitution have been killed by it. The viper may be readily distinguished from the Common Ringed Snake by its bold dark markings, and especially by those on the head. These never vary, but the ground-colour may be olive-brown or nearly black. There are two or three varieties. The length of an adult is about two feet. The viper never attacks unless provoked or disturbed. The Asp (q.v.) belongs to the same genus. The African and Indian species are very venomous. [CERASTES.]

Virgil (PUBLIUS VERGILIUS MARO). (70–19 B.C.), the greatest of Roman poets, was born on his father's farm beside the Mincio in the district of Andes, near Mantua. He was educated at Cremona and Mediolanum, and in his nineteenth year proceeded to Rome, where he applied himself to rhetoric and studied philosophy under Siron the Epicurean. In 42 B.C. his father's farm was absorbed into one of the colonies established for the disbanded soldiers of Octavianus, and although the influence of Asinius Pollio enabled him to secure its temporary restitution, he was expelled by the new proprietors, and after a short residence in Siron's villa settled in Rome. Here he soon gained the friendship of Horace, Varius, and Gallus, and became one of the brilliant band of men of letters who gathered round Mæcenæ. In 37 appeared a collection of ten *Eclogues*, or pastorals, one of the

three great poems on which his fame rests. Although both in manner and matter they betray a more or less close imitation of Theocritus, they were hailed with enthusiasm, for they showed that the Latin language possessed an unsuspected capacity of giving beautiful expression to the tender and refined sentiments of the poet. Soon after their publication he withdrew to Campania, where the patronage of Mæcenas placed him beyond the fear of poverty. Here, either in his villa at Naples or his country house near Nola, he passed seven years of peaceful retirement, engaged in the composition of the *Georgics*, a poem in four books on the art of husbandry. The remaining years of Virgil's life were devoted to the *Æneid*, an epic poem in twelve books describing the fall of Troy, the wanderings of Æneas, and the foundation of the kingdom in which tradition saw the germ of the Roman Empire. It was not destined to receive the final revision of its author, who, after a life of constant ill-health, died at Brundisium, on his return from a visit to Athens. The *Culex*, *Moretum*, *Copa*, and a few other short pieces of no great value are also ascribed to Virgil.

Virginia, one of the United States of America, occupies an area of 38,348 square miles, between Maryland N. and E., West Virginia W., and North Carolina and Tennessee S. Part of its eastern boundary is formed by the estuary of the Potomac and Chesapeake Bay. Until the War of Secession the two Virginias formed one state, which had grown out of the earliest British settlement on the continent, and was named by its founder Raleigh in honour of Queen Elizabeth. The Appalachian or Alleghany range (1,000 to 6,000 ft.), running N.E. to S.W., roughly divides the two portions, and throws out lateral spurs, enclosing rich valleys, which yield the finest cotton and tobacco, with many other temperate and subtropical products, and afford fine pasturage. The country is well watered by the Potomac, Pianketauk, York, James, Roanoke, and other rivers, whilst the coast abounds with fish, and with its many inlets offers great facilities for trade. Miasmatic districts are found on the coast, *e.g.* the Great Dismal Swamp. Gold, iron, copper, lead, zinc, coal, marble, and gypsum are among the mineral resources. Richmond is the capital, and among other important centres are Lynchburg, Fredericksburg, Alexandria, Petersburg, Portsmouth, Norfolk, and Winchester.

WEST VIRGINIA has an inland area of 24,780 square miles, being wholly surrounded by Virginia E. and S., Ohio and Kentucky W., and Pennsylvania N. Physically it resembles Virginia proper, from which it separated itself in 1861 to join the Federal cause. It has, however, a colder climate and a less rich and well-watered soil. The chief river is the Great Kanawha, a tributary of the Tennessee and Ohio.

Virginian Creeper, or AMERICAN IVY (*Ampelopsis hederacea*), a beautiful shrubby climbing plant belonging to the vine family and closely allied to the genera *Vitis* and *Cissus*. It is a native of Virginia, but grows luxuriantly in this

country. Its leaves are quinate, whence it is sometimes known as "five fingers." They turn a brilliant crimson in the autumn. The plant produces branched tendrils (q.v.), ending in remarkable *haptera* or adhesive disks. The flowers are small, yellowish, and paniculately clustered. An allied species (*A. tricuspidata*), known in nursery-gardens as *A. Veitchii*, has simple leaves, sometimes trilobed, and a closer growth against walls.

Virginian Quail (*Ortyx virginianus*), a quail ranging from Canada to the Gulf of Mexico. It is often called "Bob-White," from its note.

Viscacha, Biscacha (*Lagostomus trichodactylus*), a nocturnal burrowing rodent of the Chinchilla family, living in communities of from twenty to thirty between the Uruguay River and the Rio Negro. An adult male is nearly two feet long; the general hue is grey, the face is white, with two black bands.

Viscosity is the resistance offered by one layer of a fluid to the passage of another layer over it. Thus, if we stir a liquid it soon comes to rest, the motion having been frittered down to heat, and if a liquid flows over a boundary the upper layer moves fastest, the velocity being less and less the deeper we go. Viscosity may thus be considered as friction between the particles of a fluid. A fluid is considered more perfect in proportion as it has less viscosity. Cobbler's wax, pitch, and marine glue are thus exceedingly imperfect fluids, and to the casual observer they might appear to be solids; but it is a well-known fact that a lump of either, if left to itself, will slowly spread out into a thin layer; it will, in fact, flow, and the capability of flowing is the distinctive property of a liquid. Treacle is another common example of a viscous fluid, while ordinary paint, thin syrup, water, and petroleum spirit are liquids of less and less viscosity. Metals under sufficient pressure can be induced to flow like liquids, as is exemplified in the drawing of wire and squirting of lead tube, and in these circumstances they exhibit varying degrees of viscosity.

Vishnu ("PRESERVER"), the second deity in the Hindu triad. At first regarded as god of the sun, he was afterwards exalted to a supreme position by endowing him with the attributes of many other gods. The purpose of his incarnations (*avatars*), in which he has assumed the shape of various animals, has ever been the welfare of mankind.

Vision. The construction of the eye (q.v.) is such that a pencil of rays is refracted in it and becomes more convergent; thus a real inverted image is formed near or on the retina. The object emitting the rays will be clearly seen by the possessor of the eye when the image is sharply defined on the retina. An ordinary eye is able to adapt itself, by altering the focus of its crystalline lens, so that it can see objects at any distance with ease. Near-sighted people can, however, not manage to see distant objects however they may try to adjust their eyes. Artificial means have, therefore to be adopted to decrease the convexity

of the natural lens, and spectacles (q.v.), adding their effect to that of the refracting media in the eye, produce an image on the retina of a far-off object. The opposite compensation is made for long-sighted people. The advantage of having two eyes instead of one is that we are enabled up to a short distance to judge of solidity, the effect being similar to that produced by the stereoscope (q.v.). Since each eye is directed towards an object, the angle between their optic axes will vary with its distance; this gives us a means of estimating distances, while a further guide to the same is obtained by an alteration in the position of the observer, who notices the change in the relative positions of two objects nearly in the same straight line with himself.

Vistula, THE (German *Weichsel*), a river of Central Europe, which takes its rise at the foot of the Carpathians in Austrian Silesia, and after a northerly course of 590 miles falls into the Baltic near Dantzic by three mouths. It traverses Galicia, Russian Poland, and Prussia, receiving on the right the Dunajec, San, Wieprz, Bug, and Drewentz, and on the left the Pilica, Bzura, and Brahe. Cracow, Warsaw, Modlin, Thorn, and Elbing are on its banks.

Vitreous Rocks closely resemble artificial glass or slag in composition, texture, and other characters, having, like those substances, undoubtedly resulted from comparatively rapid cooling from a state of fusion. They often exhibit a streakiness known as *fluxion-structure*, or, from contraction in cooling, are divided up by crossing cracks and concentric shells known as *perlite* structure, from a resemblance to pearls; or contain gas cavities or bubbles, when they are known as *scoriaceous*, or *pumiceous*. When these cavities are filled in with some lighter-coloured mineral the rock is termed an amygdaloid (q.v.). Under the microscope vitreous rocks sometimes exhibit spherical clusters of radiating fibres known as *spherulites*. In almost all cases they contain scattered enclosures, which are either crystals that have resisted fusion; *crystallites* [CRYSTALLOIDS], globules of imprisoned gas, or cavities containing liquid, chiefly water, but not filled by it, thus leaving a bubble. The principal vitreous rocks are *obsidian* (q.v.), *pithstone* (q.v.), *perlite*, an opaque, perlitic, enamel-like, felspathic glass, *pumice*, a vesicular glass, varying widely in composition and colour, and *tachylite*, the glassy coating of basalt flows. [BASALT.] By the increasing development of enclosures vitreous rocks pass into semi-crystalline ones; obsidian into trachyte; tachylite into basalt, etc. They are then said to be *devitrified*.

Vitriols. A number of compounds are known as vitriols, all of which are derived from sulphuric acid, which was formerly (and still is) known under the name of *oil of vitriol* or simply *vitriol*. The iron salt, a ferrous sulphate, is a green salt which forms monoclinic crystals containing 7 molecules of water. It is known commercially as copperas

or *green vitriol*, and sulphuric acid owes its commercial name to its former preparation from this source. *Blue vitriol* consists of the sulphate of copper, CuSO_4 , which crystallises with 5 molecules of water and forms large blue triclinic crystals. When heated the water is expelled and the copper sulphate remains as a white powder of use as a drying agent. The *white vitriol* of commerce is composed chemically of sulphate of zinc, ZnSO_4 , and like green vitriol crystallises with 7 molecules of water. All four compounds are largely used in our industrial processes; indeed, oil of vitriol is of some use directly or indirectly in almost all. Green vitriol is employed in the manufacture of ink, in dyeing, and is useful in the chemical laboratory; blue vitriol also is a commonly employed reagent, and is much employed for the destruction of phylloxera, while white vitriol finds application in dyeing, calico-printing, and medicine.

Vizier (Arabic *vazîr*, "burden-bearer"), a title conferred in the 8th century on the chief minister of the first of the Abassid Caliphs, and afterwards borrowed from the Saracens by the Persians, Turks, and other Eastern peoples. The famous Barmecides were one of the earliest lines of viziers. In the Ottoman Empire the title was ultimately given to the heads of all the ministerial departments comprised in the divan, and likewise to provincial governors, the president of the divan being distinguished as *vézîr-agam* (grand vizier), but the latter designation is now obsolete.

Voguls, a Finnish people, a branch of the eastern or Ugrian group, closely allied to the Ostyaks, and with them formerly collectively known as Manzi. They occupy the eastern slopes of the Ural Mountains north of Yekaterinburg, and especially the valley of the River Konda. The Voguls have been nominal Christians since the beginning of the 18th century, but still practise many Shamanist rites. Many have become assimilated to the Russians in dress and social habits, and not more than 30,000 are still of Finno-Ugrian speech.

Volatile Oils are a class of compounds obtained usually from vegetable sources by extraction with solvents or by distillation with or without the addition of water. They are generally capable of being distilled without undergoing decomposition. In their characters they vary considerably. They are mostly colourless if pure, but have usually a slight yellow tint. They do not show the viscosity of ordinary oils, but run freely, and though miscible with alcohol, benzene, etc., are insoluble in water. A large number consist of ethereal salts of organic acids, and are very largely employed as flavouring agents and in perfumery and medicine. Examples of such are oil of cloves, essence of pears, etc. Others consist almost entirely of hydrocarbons, usually of the benzene or aromatic series, as oil of turpentine, oil of thyme. The rest are distributed amongst a large class of compounds, as the aldehydes (oil of bitter almonds), phenols, and the sulpho-compounds which are usually characterised by a strong, disagreeable, and suffocating odour,

the best-known of such compounds being ordinary mustard oil. [OILS.]

Volcano, a mountain originally of conical form, its slope, in whatever part of the world it occurs, being a similar curve, formed by the accumulation of fragmentary and molten rocks [TUFF, LAVA] ejected by the force of internal heat. Volcanoes commonly occur in mountain-chains near the sea, in some cases noticeably forming lines in connection with the great ocean-basins. In size they vary from mere mounds a few yards in diameter, such as the *salses* or *mud-volcanoes* near the Caspian, to Etna, 10,800 feet high, with a base 30 miles in diameter; Cotopaxi, in the Andes, 18,887 feet high; or Mauna Loa, in the Sandwich Isles, 13,700 feet high, with a base 70 miles in diameter and two craters, one of which, Kilauea, is the largest active crater in our earth, being 7 miles in circuit. [CRATER.] Though the first formation of a volcano has seldom been witnessed, it would seem that it is marked by earthquake movements followed by the opening of a rent or fissure, but with no such tilting up of the rocks as was once supposed to take place. From this fissure large volumes of steam issue, accompanied by hydrogen, nitrogen, carbon-dioxide, hydrochloric acid, and sulphur-dioxide. The hydrogen, apparently derived from the dissociation of water at a high temperature, flashes explosively into union with atmospheric oxygen, and, having exerted its explosive force, the steam condenses into cloud, heavy masses of which overhang the volcano, pouring down copious rains. This naturally disturbs the electrical condition of the atmosphere, so that thunder and lightning are frequent accompaniments of an eruption. The hydrochloric acid probably points to the agency of sea-water. Besides the gases just mentioned, sulphuretted hydrogen, ammonia, and common salt occur, but mainly as secondary products formed by the union of the vapours issuing from the volcano, and commonly seen also in the vapours rising from cooling lava streams or dormant volcanic districts. It is important to notice that the vapours issue from the volcano spasmodically, explosions succeeding each other with great rapidity and noise.

All substances thrown out by the volcano, whether gaseous, liquid, or solid, are conveniently united under the term *ejectamenta*, and all of them are in an intensely heated, if not in an incandescent, state. Most of the gases are incombustible, but those containing sulphur and hydrogen burn with a blue flame, rendered perhaps more visible by the presence of solid particles. Much of the so-called flame, however, in popular descriptions of eruptions, is an error of observation due to the red-hot solid particles and the reflection of the glowing orifice on the overhanging clouds.

Solid bodies are thrown into the air with enormous force and to proportionally great heights, those not projected vertically falling in consequence at considerable distances from the volcano.

It is the explosive force from below which keeps the crater clear, as a cup-shaped hollow truncating the cone, and all stones falling into it would only

be thrown out again. It may, at the close of an eruption, cool down so completely that a lake may form within it, such as Lake Averno, near Naples; or it may long remain a seething sea of lava, such as Kilauea; or the lava may find one or more outlets from it, either by welling over its rim, which it will then generally break down (as in many of the small extinct volcanoes—"puys"—of Auvergne), or more usually by bursting through the sides of the cone:

It is not generally until the volcano has exhausted its first explosive force that lava (q.v.) begins to issue. Several streams may issue in different directions. Their dimensions are sometimes enormous. Lava varies much in liquidity, and in the rate at which it flows. This depends much, however, on the slope it has to traverse. Glowing at first as a white-hot liquid, the lava soon cools at the surface to red and then to black: cinder-like scoriaceous masses form on its surface and in front of the slowly-advancing mass: clouds of steam and other vapour rise from it; and little cones are thrown up from its surface; but many years may elapse before the mass is cooled through. Thus, while the surface is glassy, the interior becomes crystalline. The dark glass-like lava, abundant in Mexico, where the ancient inhabitants used it for knives, is known as *obsidian* (q.v.); the froth or scum of the stream, filled with gas-cavities, as *pumice*.

As the temperature of the volcano falls hydrogen ceases to be given off, but nitrogen and carbon-dioxide increase in quantity. *Fumaroles*, or smoking vents, both in the crater and on lava-streams, emit these gases, sometimes long after an eruption, together with alkaline compounds of soda, potash, lime, and sulphur, or, as the temperature falls, with acids. *Fumaroles* rich in sulphur, which they often deposit in crystals, are known as *solfataras*, and in Tuscany jets, known as *soffioni*, give off steam and boracic acid, the heat of the former being economically employed to concentrate the latter. Bright-coloured chlorides, sulphate of lime, alum, and other minerals encrust the crater as it cools.

Vole, any species of the genus *Arvicola*. There are about forty species of these mouse-like rodents, widely distributed over Europe, Asia, and North America. Three occur in Britain: the Water Vole (*A. amphibius*), often miscalled the water-rat, with dark-brown fur; the Field Vole (*A. agrestis*), or short-tailed field-mouse, clothed in brownish-grey; and the Bank Vole (*A. glareolus*), with rusty-brown fur. The last two are about the size of mice, but more stoutly built. They feed chiefly on vegetable substances. Within recent years they have multiplied in the North of England, Scotland, and in Greece to such an extent as to become a plague. This increase is probably due to the way in which gamekeepers destroy hawks, owls, weasels, etc.

Volga, or WOLGA, THE, a river of European Russia, which rises in the Valdai Hills, and flowing with many windings to the E. as far as Kazan, there turns S., and, after a course of 2,200 miles,

enters the Caspian Sea below Astrakhan by many mouths. It is navigable throughout almost all its length, and by means of affluents and canals communicates with every part of Western Russia. The towns of Tver, Jaroslav, Nijni-Novgorod, and Saratov are on its banks. Fish abound in its waters, especially the sturgeon and salmon.

Volsungs, a family in the ancient Teutonic mythology, whose story is the theme of the Icelandic *Volsunga Saga*, a work of the twelfth century. Siegfried, in the *Nibelungenlied* (q.v.), belonged to the same race.

Volt, in *electricity*, is the practical unit of electromotive force, difference of potential, or electric pressure. [ELECTRICITY.] It is the pressure needed to force a current of one ampère through a resistance of one ohm, and is 10^8 C.G.S. units of potential. The most commonly used standard of pressure is the Clark cell, which has been found, when set up in a definite way, to give a definite difference of potential, which, however, varies with the temperature, and is equal to $1.438 [1 - 0.00077 (t - 15^\circ)]$ legal volts, where t is the temperature in degrees Centigrade.

Voltaire, FRANÇOIS MARIE AROUET DE (1694-1778), was the son of a notary at Paris, where he was born. The letters written during his school-days at the Jesuit College of Louis le Grand already show an innate tendency to scepticism. His repugnance to the legal profession was a great disappointment to his father, who, in order to divert his mind from the dissipations of Paris, sent him in the suite of the Marquis de Châteauneuf to the Hague; but here he formed an attachment to a Protestant which occasioned his recall (1713). In consequence of some lampoons on the Duc d'Orléans, he was imprisoned for eleven months in the Bastille (1717-18). On his release he assumed the additional name of Voltaire, an anagram of Arouet l. j. (le jeune). In the course of the same year his first tragedy, *Œdipe*, was acted with great success at the Théâtre Français. A fracas at the house of the Duc de Sully led to his banishment to England in May, 1726. During his stay in this country, which lasted three years, he won the favour of Queen Caroline, and made many friends in the worlds of politics and letters. Amongst these Bolingbroke seems to have exercised the most enduring influence on his mind. The *Henriade* (which had already appeared secretly at Rouen in 1723 under the title of *La Ligue*) was now published in London with a dedication to the queen (1728). After his return to France he acquired much money by prudent speculations, and in 1731 printed his *Charles XII.*, which he had written in England. His *Lettres Philosophiques sur les Anglais* (1733) gave great offence, and to escape prosecution Voltaire took refuge with his friend, Madame du Châtelet, at the Chateau of Cirey (1734). Here he spent the greater part of the five following years, producing amongst other work the drama of *Mérope* and much of the *Siècle de Louis Quatorze*, and devoting much time to the study of natural science. Having the good fortune to commend himself to Madame de Pompadour,

he was restored to favour at Court, and in 1745 received the appointment of historiographer royal. In consequence of fresh rebuffs he betook himself, with Madame du Châtelet, to the court of Stanislaus, ex-King of Poland, at Lunéville (1748), and after her death (1749) accepted a long-neglected invitation of Frederick II. to take up his abode at Berlin (1750). Voltaire quarrelled with his patron before three years were over, and was glad to find an opportunity of escaping from his court. To the first five years of his sojourn in Switzerland belong *Les Mœurs et l'Esprit des Nations*, the poem on the earthquake at Lisbon (1756), and the novel of *Candide* (1759). His exertions on behalf of Calas (q.v.) should be remembered to his honour. In 1778 he went to Paris to witness the performance of his tragedy, *Irène*, but the excitement was too much for the feeble old man, and his excessive use of opiates brought on an illness which ended in death.

Volume is measured in terms of some convenient unit of volume, and the best unit of volume to choose is the cube of the unit of length. The cubic foot is, however, little used in England commercially, gas being one of the few things which are measured in this way; in most other cases a perfectly arbitrary unit is selected, such as the gallon or bushel. The volume of a rectangular body is obtained by multiplying its length, height, and breadth; that of a sphere is $\frac{4}{3} \pi r^3$, where r is the radius and π is the ratio between the circumference and diameter ($\pi = 3.1416$ nearly). The volume of a right cylinder is found by multiplying its height by π times the square of its radius, and that of a cone is one-third the volume of the cylinder on the same base, and of the same height. Most substances alter their volume on changing their state. Ice occupies a greater volume than the water which produces it, hence the bursting of water-pipes in a frost. Solid cast-iron also occupies a greater volume than the molten metal, hence, as it cools, it thrusts itself into every part of the mould. It is this property which makes it so important, most other metals contracting during solidification, and so being useless in casting.

Volumetric Analysis is a method of quantitative analysis in which substances are estimated by the volume of some standard solution required to complete some reaction. The close of the reaction is usually known by adding what is called an *indicator*. Thus, if the quantity of an acid is to be determined, a little litmus solution may be added as indicator, and the acid neutralised by the addition of a standard solution of soda. As soon as the neutralisation is complete, the further addition of a drop of soda changes the colour from red to blue, and hence by the volume of soda required to just turn the liquid blue the quantity of acid present is known. A very large number of methods are available in volumetric analysis which, where available, usually possess the advantage of speed and the capability of making several consecutive determinations.

Volunteers, citizens who place their services at the disposal of the State for military purposes without demanding any payment in return. The

oldest body of this kind in England, the Honourable Artillery Company of London, is identical with the Guild of St. George, which received a charter from Henry VIII. in 1537. The first regular organisation of volunteer corps throughout the country took place in 1794, when a French invasion seemed imminent. On the renewal of war in 1803 the Military Service Bill was passed, providing for the enrolment of all able-bodied men as volunteers. By 1805 the total number (including those raised in Ireland) had risen to more than 400,000, but when peace was concluded they were all disbanded with the exception of the yeomanry or volunteer cavalry, which still survives. No further effort was made to raise an efficient volunteer force till 1859, when England was roused to a sense of her danger by the threatening attitude of the French press. The Government, convinced of the desirability of keeping up the force, determined to defray these and other expenses by means of an annual capitation grant out of the public funds (1862). At the same time a higher standard of military proficiency was required. In 1870 an Act was passed transferring the immediate authority over the volunteers from the lord-lieutenants to the Crown. The result was that they were brought under the direct control of the War Office and drawn into much closer relations with the regular army.

Volutidæ, a family of Gastropoda (q.v.), including many of the largest and most highly coloured of univalve mollusca. The shell is generally of a turret shape, has a long mouth, notched at the lower end. The type-genus *Voluta* began in the Cretaceous, but this and the other members of the family, such as *Initia* and *Marginella*, are most characteristic of the Tertiary. They are all marine.

Volvox, a genus of fresh-water algæ. It has a spherical cœnobium of a pale-green colour, which is constantly rotating and changing place.

Vomer. [SKULL.]

Vomiting, a symptom met with in disease under a great variety of conditions. It may occur as the result of the ingestion of poisonous or irritant substances, or as the result of poisonous principles developed in the course of certain diseases and circulating in the blood. Thus vomiting is a common symptom of the onset of many forms of acute disease. It is again due to a number of morbid conditions affecting the stomach, and it may result from reflex nervous action, as, for example, in hepatic and renal colic, in strangulated hernia, and in disease of the pelvic organs. The morning sickness of pregnancy is an example of such reflex vomiting. Again, vomiting may occur in the case of disease affecting the central nervous system. (For the vomiting of blood, see HÆMATESIS.)

Vortex. Simple circular vortex rings may be produced by filling a box with smoke, making a round hole in one side of it, and replacing the opposite side with a stretched membrane or cloth. A succession of blows on the cloth causes a succession of circular smoke rings to emerge from the hole. The same thing is often obtained when

a gun or mortar is fired, or when a man exhales tobacco smoke in a particular way. The properties of such rings were first deduced by Helmholtz, and upon these Lord Kelvin has based a theory of the structure of matter. It is noticed that if two smoke rings are following one another, the front one opens out and moves more slowly, while the ring behind contracts and increases its speed till it finally passes *through* the other; it in turn then opens out, and the two rings alternately pass through each other. If two rings are moving towards each other, both open out and move more slowly, never actually reaching each other. A vortex smoke-ring contains, besides the visible smoke, an amount of rotating air, and as the ring moves onwards it consists of the *same* air and smoke all the time. This air then has become differentiated from the rest of the atmosphere, and moves through it as though it were a ring of metal. Helmholtz showed that in a perfect fluid—one in which fluid friction did not exist—the vortex ring would go on moving for ever. But if the air had been a perfect fluid we could not have started the vortex ring at all. The vortex ring of a perfect fluid is therefore uncreatable and indestructible. Lord Kelvin supposed that the universe might be filled with a perfect fluid, in which vortex filaments of different shapes, having once been started, would go on for ever; hence these vortex filaments might be considered as the fundamental atoms of matter which we cannot destroy or create. Helmholtz further proved that vortex filaments in a perfect fluid must be either endless—*i.e.* ring-shaped, though the ring may be twisted in a multitude of ways—or the ends must be in the surface of a liquid. We can get examples of the latter by moving a teaspoon rapidly through a cup of tea, the bowl of the spoon being only half in the liquid. The two little eddies observed are the ends of half a vortex ring. In Lord Kelvin's infinite fluid there can be, of course, no ends, so all atoms on this hypothesis must be closed vortex rings. Helmholtz showed that a vortex ring cannot be cut; a sharp knife may be brought up to it, but the ring gets out of its way. In this, again, it is like an atom; it is indivisible.

Vorticella, the Bell-Animalcule (q.v.).

Vosges. 1. A department of France, taking its name from the above range, has an area of 2,347 miles, mostly mountainous and wooded, but to the W. and N.W. it extends a fertile plain, where cereals of all sorts, white hemp, and flax are grown, and where dairy-farming prospers. Black cherries are cultivated in great quantities for the distillation of *Kirsch-wasser*. Iron, copper, silver, and marble are profitably worked. Épinal is the capital, and among other towns may be named Plombières (famed for mineral waters), Remiremont, St. Dié, and Neufchâteau.

2. THE VOSGES (German *Vogesen*), a chain of mountains which begins in the departments of Haute-Saône and Haut-Rhin, France, and skirting Belgium, ends near Mainz on the Rhine, being connected by subsidiary spurs with the Côte d'Or and Cevennes at one end, and the Ardennes at the

other. The form of the hills is often rounded, and their highest elevation is under 5,000 ft. They are thickly wooded, and shelter wolves and wild boars. The Saône, Moselle, Meuse, Marne, and Aube have their origin here, and the mineral resources are considerable, rock-salt being the most valuable commercially.

Vulcan, the old Roman fire-god, afterwards identified with the Greek Hephæstos (q.v.).

Vulcan. The motions of the planet Mercury have always been somewhat different from those deduced by calculation. In 1859 Leverrier, after a careful examination of the details of all the transits of this planet, found that the perihelion of Mercury's orbit moves 38" in a century more than can be accounted for by the action of the other planets. This, he said, could be explained by supposing an undiscovered planet to exist between Mercury and the sun. Immediately an announcement came from Dr. Lescarbault, a physician of Orgères, that he had actually seen such a planet about six months previously. Leverrier hastened to see him, and, convinced of the accuracy of the observation, named the new planet Vulcan, calculating for it further a period of revolution rather over nineteen days. Vulcan, however, was seen no more. In 1876 Weber announced its transit, but the supposed planet was found to be only a sun-spot. From other supposed appearances Leverrier calculated that he should be seen in transit on March 22nd, 1877, and again in 1882. No search, however, revealed him, and his supposed appearance in the total eclipse of July 29th, 1878, was probably due to a mistaken estimation of certain stars. Belief in Vulcan has consequently waned, and the peculiarity of Mercury's movements remains unexplained.

Vulcanite is prepared by the union of caoutchouc with about half its weight of sulphur. If the proportion of sulphur is less than this, the product is generally known as vulcanised caoutchouc. The union is effected by thoroughly incorporating the caoutchouc and flowers of sulphur by kneading together on warm rolls and maintaining for about six hours at a temperature of from 270° to 350° F. Small articles of caoutchouc may also be vulcanised by immersing in a mixture of carbon disulphide and chloride of sulphur, and allowing the liquid to evaporate at an ordinary warm temperature (75° to 80° F.).

Vulgate, the Latin version of the Bible translated by St. Jerome at the close of the 4th century.

Vulture, any bird of the Raptorial family Vulturidæ, chiefly from subtropical and tropical regions of both hemispheres. They are large birds, of repulsive habits, but they fulfil an important duty as scavengers by clearing away carrion and garbage. The head and neck are generally bare, or covered with scattered tufts of down; the feet are large and well fitted for walking, but the claws are weak, and this fact prevents them from grasping and carrying off living prey. They feed their young by bringing up the contents of the crop. The American vultures differ from those of the Old World in having no bony partition between the nostrils.

The chief species are the Black Vulture (*Vultur monachus*) and the Griffon (*V. fulvus*), which are found in Southern Europe, the Eared Vulture (*Otogyps auricularis*) from Africa, the Indian Vulture (*O. calvus*), and the Egyptian Vulture (*Neophron percnopterus*). [CONDOR, LAMMERGEIER.]

W.

W, the twenty-third letter of our alphabet, is a labial consonant corresponding to the vowel u.

Wace, MASTER (1120-80), trouvère (often without any authority called "Robert Wace"). Born in Jersey, he was the author of two metrical chronicles, *Le Roman du Brut*, apparently a paraphrase of Geoffrey of Monmouth's *History*, and *Le Roman de Rou*, which records the fortunes of the Norman dukes down to 1106.

Wad. [PYROLUSITE.]

Wafers, thin brittle discs of dried paste, usually made of flour and water, which, in the case of coloured wafers, are mixed with non-poisonous colouring matter. They were formerly used as a ground on which to stamp seals, but the purpose to which they are now chiefly put is that of fastening papers together.

Wagering. All contracts or agreements, whether verbal or in writing, by way of gaming or wagering, are null and void, and no action is maintainable for recovering any money or other valuable article alleged to be won upon any wager, or which has been deposited in the hands of any person to abide the event of the wager.

Wagner, Richard [1813-83], was born at Leipzig, and early showed signs of his genius for music. In 1833 he wrote his first opera *Die Feen*, and this was followed by *Rienzi* (1838), *The Flying Dutchman* (1844), and *Tannhäuser* (1845). Up to this time he had been content to follow, more or less, the conventions of the old Italian opera, but in *Lohengrin* (1848), his next work, he commenced to develop his theories of the new opera. In 1854 *Das Rheingold* was completed, and this was followed by *Die Walküre* in 1856, *Siegfried* (1869), *Die Götterdämmerung* (1874) completing the cycle of the Nibelungen Ring Trilogy. He had, however, meanwhile composed *Tristan und Isolde* (1865), and his comic opera *Die Meistersinger* (1868). In 1882 his greatest work, *Parsifal*, was produced at Baireuth, at the theatre specially built for him by Ludwig of Bavaria. In 1870 Wagner married Cosima, daughter of Liszt, and formerly wife of Von Bülow. His prose works are almost as remarkable as his operas, which certainly mark an epoch in the history of music.

Wagtail, any bird of the Passerine genus *Motacilla*, with about thirty species, ranging over the greater part of Europe, Asia, and Africa, and to Alaska. Wagtails are active, graceful birds, generally found in open pastures, and by the banks of ponds and streams, feeding on insects and small

molluscs. They are continually in motion, and derive their scientific and popular names from their habit of jerking the tail up and down. Five species are British. The Pied Wagtail (*M. lugubris*) is about seven inches long, with black-and-white plumage. It is one of the best-known British birds, and no one who has ever seen it standing on a stone in a stream and flirting its tail can ever mistake it. Other British species are the Yellow Wagtail (*M. rayi*), the Blue-headed Wagtail (*M. flava*), the White Wagtail (*M. alba*), and the Grey Wagtail (*M. boarula*). Some of these were formerly placed in different genera, principally on account of their coloration.

Wahabee, one of the followers of Abd-el-Wahab (1691-1787), a Mohammedan reformer, who opposed all practices not sanctioned by the Koran.

Wakefield, a town on the River Calder in the West Riding of Yorkshire, 9 miles south of Leeds, and served by four lines of railway. It was the scene in 1400 of the defeat and death of Richard, Duke of York, and played a part, too, in the Civil War. The restored parish church has the highest spire in the county, and there is a grammar school founded by Queen Elizabeth. The manufacture of woollen yarns, cloths, and hosiery has long been carried on here, and the market is very important. The now extended borough returns one member to Parliament.

Waldeck-Pyrmont, two territories of North Germany forming a principality, governed by a hereditary prince, but wholly subordinate to imperial authority. Waldeck has an area of 407 square miles, and is enclosed by Prussia, Westphalia, and Hesse-Cassel. Pyrmont lies north, and its 25 square miles are surrounded by Hanover, Brunswick, and Lippe-Detmold. Both divisions are in the basin of the Weser and consist mainly of hills and forests, with fertile valleys and pastures. Cattle, timber, fine wool, iron, and honey are exported, but the mineral waters of Pyrmont supply the bulk of the revenue. Arolsen and Pyrmont are the chief towns.

Waldenses, a Christian community named from Peter Waldo, a rich citizen of Lyons, who, about 1170, divided his wealth among the poor, and became the leader of a body of wandering preachers. The Waldenses were expelled from Aragon in 1194, and went to Strasburg, where a party of them were burned in 1212. Many of them perished in the crusade against the Albigenses (q.v.), though they were not open to the charge of heresy, and in 1218 they were condemned by the fourth Lateran Council. In 1532, however, a synod was held in the Valley of Angrogna, in which it was resolved to accept the doctrines of the Calvinists, and conform to their religious usages. From this time they became merged in the general body of Protestants, but they were still liable to outbursts of persecution such as that which called forth Milton's noble sonnet in 1655.

Wales, one of the three great divisions of the island of Great Britain, is bounded on its eastern side by the English counties of Cheshire, Shrop-

shire, Hereford, and Monmouth, and on the other three sides is washed by the sea. Its greatest length, N. to S., is 135 miles; its breadth, E. to W., varies from 37 miles near the parallel of Aberystwith, where it is narrowest, to 95 miles near the parallel of St. David's, where it is widest. It has an area (ancient counties, not registration counties) of 7,468 square miles, and a population, according to the census of 1891, of 1,519,035. Though administered in the main as a part of England, it is recognised by Parliament as an organic and homogeneous unit, and as such has received separate and distinctive treatment in the Intermediate Education and other exclusively Welsh Acts.

The names Wales and Welsh are from a Teutonic root, meaning "foreign" (compare Ger. *Wälsch* =



MAP OF WALES.

"Italian"), but the Welsh themselves call their country Cymru and its people Cymry—names which, however, according to Professor Rhys, did not originate earlier than the 6th century. The country is divided into twelve counties, the largest being Caermarthenshire, and the most populous Glamorgan, and its present dimensions date from 1535, when Henry VIII. severed Monmouthshire from Wales and joined it to England. Its general aspect is bold, romantic, and mountainous. It is intersected by beautiful valleys, and traversed by numerous streams, and although it has no rivers of any magnitude, it gives rise to the Severn and the Wye. The principal mountains of North Wales are the Snowdon group, with Y Wyddfa (3,571 feet) as its culminating pinnacle, the Cader Idris chain, and the Berwyn range, while in South Wales are the

Beacons of Brecon and Caermarthen, and the Black Mountains. Though largely an agricultural country, Wales contains some of the most important coal-fields and iron industries of Great Britain, and in a lesser degree produces lead and copper; gold is found in Merionethshire, and silver-mines used to be worked in Cardiganshire, where, in the 17th century, a coinage was issued stamped on one side with the ostrich plumes of the Prince of Wales. The largest slate-quarries in the world lie in the Cambrian rocks of Caernarvonshire. The Church of England is legally established there, but is greatly outnumbered by the various Nonconformist bodies. Wales sends thirty representatives to the Imperial Parliament.

Language and Literature. Though English is very generally understood throughout Wales, and has even largely displaced the native tongue in Radnorshire, part of Pembrokeshire, Gower, Cardiff, and other towns in South Wales, Welsh is still spoken, according to the census of 1891, by 910,289 people in Wales and Monmouthshire. It is full of life and vigour, and though not to any great extent the language of commerce, it is still the language of social life, of religion, and of literature. In 1865 a Welsh colony was established on the Chupat River in Patagonia. Modern Welsh literature is both large in quantity and progressive in excellence, and over forty newspapers and periodicals are now being issued in the Welsh language. Classic Welsh literature has a continuous history extending from the 6th century to the present day, divided by Stephens, in his *Literature of the Kymry*, into four periods. Of the productions of the first of these little exists besides the *Gododin* of Aneurin (q.v.). In the second, between 1080 and 1350, appeared a number of lyric poets, remains of whose works we still possess, and whose themes were principally patriotism and war. Among them were Gwalchmai, Hywel ab Owain, Cynddelw, and Rhys Goch ab Rhiccert. It was in this period that the Arthurian and other romances known as the *Mabinogion* were written down, having probably been in circulation as tales for centuries before. The Welsh traditions of Arthur and his knights have had a marked influence on the literature of Europe. In the third period (1350 to 1650) flourished Dafydd ab Gwilym, the most celebrated of all Welsh poets, Lewis Glyn Cothi, Tudur Aled and Rhys Pritchard; and to this era most of the Welsh Triads are attributed. The fourth period begins with the poet Huw Morus, and includes Goronwy Owen, Elis Wyn, Eben Fardd, Carnhuanawc, Dr. Lewis Edwards, Daniel Owen, and many others. Classic Welsh poetry is weighed down by the iron chains of alliteration, and the rules of "cynghanedd." Welsh prose is largely theological and biographical; the drama is absent except in the interludes of Twm o'r Nant, and the novel has only lately come into existence in the works of Daniel Owen.

History. The real history of the Welsh people, as distinguished from the fortunes of kings and princes, remains yet to be extracted from the poetry, the traditions, and the ancient laws of Wales, in which it lies buried. The history of

Wales as an independent political community is one long tragedy of internal strife, attacks from without, and final conquest by Edward I. After the Romans left Britain, about the year 410, the two Britanniæ were governed by native successors of the Dux Britanniarum called Gwledigs, who probably continued for a long time to hold some sort of lordship over the British states, comprising Wales proper, Cornwall, Cumbria, and Strathclyde. By the battle of Deorham in 577 Cornwall was isolated, and by the battle of Chester in 613 Wales proper was separated from the other British states. The two Gwledigs of whom we know anything were Cunedda Wledig early in the fifth century, and Maelgwn Gwynedd in the 6th, and their descendants appear not only to have reigned as princes over the various lesser states of Wales, but also to have retained amongst them the power of the Gwledig for several centuries. In the 9th century we find Rhodri Fawr reigning as king of all Wales, and after the death of his grandson, Hywel Dda, a long period of internecine strife, and wars with the Danes and the English. In 1055 Gruffydd ab Llewelyn became king of all Wales, and the next half-century is filled with the attempts of the Norman barons to establish themselves in various districts, and the efforts of the Welsh princes to expel them. Invasions of Wales were made by Harold, William the Conqueror, Rufus, Henry I., Henry II., John, and Edward I. The last century of Welsh independence is nearly covered by the long reigns of Llewelyn ap Iorwerth (1194-1246), and Llewelyn ap Gruffydd (1246-83). With the death of the latter in a skirmish on the banks of the Wye, Welsh independence came to an end.

WELSH, the inhabitants of Wales. In this nationality are merged several ethnical elements, of which the oldest appear to have been the Silurians, of unknown origin, but almost certainly non-Aryans and possibly Iberians from Spain or Aquitania. These were followed and, no doubt, largely absorbed, still in prehistoric times, by two distinct waves of Celtic migration, first the Gadhaelians, whose presence is shown by numerous geographical names, and later by the Kymry, who still form the great majority of the population. They were joined in the 5th century of the new era by many Romanised Britons, flying from the Saxon invaders; but these refugees, mostly of kindred stock, appear to have been rapidly assimilated to the dominant Kymry, who had preserved the national speech during the Roman period. Then came in the twelfth century numerous Flemish artisans, settled in South Wales (Pembrokeshire), and since that time a slight but continuous infiltration of English and Irish, by whom the Welsh domain has been largely encroached upon, especially along the marches (borderlands) between Flintshire and Monmouth, in all the seaports, watering-places, mining, and other industrial centres; but the Welsh national sentiment, which has at all times displayed immense vitality, is still dominant in most of the Principality, asserting itself in the church, in the schools, in the periodical literature, and in the *eisteddfodau*, annual musical and literary gathering, which recall the *gorsedd*, or open-air assemblies

of pagan times. Physically the Welsh belong to the dark division of the Caucasian race (q.v.), as shown especially by the prevailing dark-brown and even black hair, the dark eyes, small nose, often rather concave than straight, the light active frames, and somewhat short stature. In all these respects they approach the so-called Celtic type, as studied by Broca in Brittany, Auvergne, and Savoy, and in some of their mental qualities they also resemble the inhabitants of these regions, where the Gaulish (Kymric) race is supposed to be best preserved. They are impulsive, emotional, more religious than moral, fond of oratorical display, music and poetry, without perhaps reaching the highest excellence in any of these arts. Nevertheless, European literature is indebted to them for the Arthurian legend, and tradition preserves the memory of Taliesin and other renowned singers.

Wales, Prince of, the heir apparent to the Throne of Great Britain. Albert Edward (b. 1841) is the present Prince of Wales.

Walhalla (Icelandic *Valhöll*, "Hall of the Slain"), in Norse mythology was the abode of the Einherjar—those who had fallen bravely in battle, and as a reward lived in perpetual joy with Odin.

Walkyries (Icelandic *Valkyrjur*, "Choosers of the Slain"), the "shield-maidens" sent by Odin to every battlefield to choose the men doomed to death, and determine the victory. When the battle is over, the Einherjar, or fallen heroes, are borne away by the Walkyries to Walhalla (q.v.).

Wallace, SIR WILLIAM (c. 1274–1305), the national hero of Scotland, was the younger son of Sir Malcolm Wallace of Elderslie in Renfrewshire. After several successes, including an attack on Lanark, in which the governor was slain, he was joined by a party among the Scottish nobles, but they soon afterwards acknowledged Edward as sovereign by the Treaty of Irvine. Still supported by Sir Andrew Moray, he attacked the English forces under the Earl of Surrey, and gained a complete victory, which he followed up by a raid into England. On his return he was appointed Governor of the Kingdom, but his attempts at reorganisation were thwarted by the jealousy of the barons. Meantime Edward had returned from Flanders and hurried to Scotland, where he defeated Wallace at Falkirk (July 22, 1298). Wallace was betrayed to the English, impeached of treason, and hanged, disembowelled, and quartered.

Wallachians. [RUMANIANS.]

Wallenstein (properly, WALDSTEIN), ALBRECHT WENZEL EUSEBIUS VON (1583–1634), was born in Bohemia. After studying at the universities of Altdorf, Bologna, and Padua, and distinguishing himself in battle against the Turks, he married a widow whose wealth and estates raised him to a high position amongst his countrymen. He was appointed quartermaster-general under Tilly in Bohemia (1620), and in 1621 and 1623 rendered important services against Bethlen Gabor in Moravia. In 1625 he was made duke of the new principality of Friedland. Early in the following year he raised

an army of 30,000 men, which he placed entirely at the Emperor's disposal, and, co-operating with Tilly, conducted a brilliant campaign against Count Mansfeld. The two generals were equally successful against Christian IV. in 1627, and the Duchy of Mecklenburg, which Wallenstein had seized, was handed over to him as a reward for his services. He was baffled in his attempt to make Ferdinand supreme in the Baltic by his failure before Stralsund (1628), but the hostility of Denmark was brought to an end by the Peace of Lübeck (1629). The jealousy of the nobles, who regarded him as an arrogant upstart, led to his temporary disgrace in 1630, but the early successes of Gustavus Adolphus and the death of Tilly rendered his recall imperative, and in the spring of 1632 he was placed at the head of an army which owed obedience to him alone. After expelling the Saxons from Bohemia he marched against the Swedes and repelled the attack on his entrenched camp near Nuremberg, but was defeated at Lützen (q.v.), the battle at Gustavus lost his life. After resuming hostile operations in Lusatia he withdrew at the close of 1633 into Bohemia, and took up his quarters at Pilsen. In January a secret patent was issued depriving him of his command, and a few weeks later another was published at Prague, in which he was openly charged with treason. He hurried to Eger in Western Bohemia, hoping to find a protector in Bernhard of Saxe-Weimar, but immediately on his arrival he was murdered by Colonel Butler and Captain Devereux.

Waller, EDMUND (1605–87), poet, was born at Coleshill, in Warwickshire, and educated at Eton and Cambridge. After the death of his first wife he courted Lady Dorothy Sidney, the "Saccharissa" of his verses, but his suit was unsuccessful. After the Restoration Waller enjoyed high favour at Court, and was a very popular member of the House of Commons. His influence was exerted chiefly in reshaping the heroic couplet, which now became the favourite English metre.

Wallflower (*Cheiranthus Cheiri*), a cruciferous plant native to Southern Europe and growing commonly as an escape from cultivation on ruins, old walls, and sea-cliffs in England. It is a herbaceous perennial, pubescent, with adpressed bifid hairs; has entire lanceolate-acute leaves, corymbosely racemose flowers with long claws and large spreading limbs to the petals and pouches to the two lateral erect sepals. The silique is four-angled, the stigma sub-sessile, the seeds uniseriate and compressed, and the cotyledons accumbent.

Wallons. [BELGIUM.]

Walnut, a name of German origin, meaning foreign nut, applied to *Juglans regia*, probably a native of the mountains of Asia, from the Caucasus to Kashmir and Sikkim, to Persia, Lebanon, and Asia Minor. In Sikkim the tree grows at altitudes of from 4,000 to 7,000 feet. Walnut wood is light, a cubic foot weighing only about 47 pounds: it is tough and strong, and takes a good polish. It is the best wood for gun-stocks, and being, especially in old trees, beautifully veined, is in request for cabinet-

work. The tree has deciduous, glabrous, yellowish-green, pinnate leaves; precocious flowers, of which the males are in catkins and the female are borne three together at the end of a branch; and a fruit of an exceptional type. The receptacular tube is adherent, so that the ovary is inferior: there are generally two fleshy stigmas, and the receptacular tube forms a fleshy bitter green "epicarp," which surrounds the "nut" or "endocarp." This so-called epicarp yields a dark-brown dye. When ripe it splits irregularly, so that the fruit is termed "dehiscently drupaceous." The nut has a two-valved woody shell, containing one exalbuminous seed with corrugated cotyledons and a thin, brown, bitter testa. It is pickled whole when green. It ripens by the end of September, and is esteemed as a dessert nut. We import about 260,000 bushels, chiefly from France and Belgium.

Walpole, HORACE, EARL OF ORFORD (1717-97), third son of Sir Robert Walpole, was born in London and educated at Eton and Cambridge. He started on the grand tour in company with Gray (1739), but quarrelled with him and returned to England separately (1741). He was elected member for Callington in 1741, and continued to sit in Parliament till 1768, but very seldom took part in the debates. In 1791 he succeeded his nephew in the earldom. Walpole's tastes were those of a literary epicure. His *Anecdotes of Painting in England* (1761-71) and *Catalogue of Engravers* (1763) are of considerable value. The pseudo-romantic sentiment which inspired the *Castle of Otranto* (1764) was destined to bear abundant fruit in the novels of Mrs. Radcliffe and Monk Lewis. The *Memoirs of the Last Ten Years of the Reign of George II.* and those of the *Reign of George III.* contain matter which the historian cannot afford to neglect. But it is by his *Letters*, ranging over the period from 1735 to 1797, that Walpole will always occupy a well-earned place in English literature.

Walpole, SIR ROBERT, EARL OF ORFORD (1676-1745), statesman, was born at Houghton, his father's seat in Norfolk, and educated at Eton and Cambridge. He entered Parliament in 1702, and speedily attracted the notice of Godolphin, Marlborough, and other Whig leaders. He was appointed Secretary at War in 1708, and two years later was one of the managers of Sacheverell's trial, of which he secretly disapproved. After the return of the Tories to power he was expelled the House and imprisoned in the Tower on a charge of corruption whilst in office, but he succeeded in making good his defence, and on his release was re-elected for East Lynn. When George I. succeeded Anne, he was selected to preside over an inquiry into the conduct of the last Ministry, and in 1715 became First Lord of the Treasury and Chancellor of the Exchequer; but, owing to the king's dislike and disputes with his colleagues, he resigned in 1717, after establishing the first Sinking Fund (q.v.). Finding opposition hopeless, he rejoined the Ministry as Paymaster of the Forces in 1720, and justified the confidence of the public by his financial policy after the bursting of the South

Sea Bubble (q.v.). Left without a rival on the death of Stanhope, he became Chancellor of the Exchequer and Prime Minister in 1721, and continued in power for twenty-one years, in spite of the combined opposition of the Whig supporters of Pulteney and the Tories under Bolingbroke. During this period, however, he was preparing the way for his own fall by driving his ablest colleagues, such as Carteret and Chesterfield, into the ranks of his opponents. His pacific policy was hateful both to the king and the Opposition, and in 1739 he was driven, sorely against his will, into a war with Spain. The expeditions to Spain were unsuccessful, and in 1742 Walpole resigned, receiving at the same time an earldom and a pension. His closing years were spent in retirement.

Walrus, any individual of the genus *Trichechus*, type of a family (*Trichechidae*) of Fissiped Carnivora, intermediate between the True Seals and the Eared Seals. Some authorities recognise two species—*T. rosmarus*, from Arctic seas, and *T. obesus*, from the North Pacific, but the latter is doubtfully distinct. An adult male will measure about ten feet in length, and is very bulky, especially about the fore-quarters. There is no external ear, and on land the hind limbs are turned forward, as in the Eared Seals. The upper canines are developed into tusks, sometimes two feet long, which are used in digging up from the bottom the molluscs on which these creatures principally feed.

Walton, IZAAK (1593-1683), author of *The Complete Angler*, was born at Stafford. The first edition of *The Complete Angler* was published in 1653; it was extended by the author during his lifetime, and enlarged by the addition of Charles Cotton's continuation in 1676. He also wrote *Lives of Donne* (1640), *Wotton* (1651), *Hooker* (1652), *Herbert* (1670), and *Sanderson* (1678).

Waltz (German *walzer*, from *walzen*, "to roll"), a round dance, probably of Bohemian origin, which became popular in several European countries towards the close of the 18th century, and was introduced into England in 1813.

Wandering Jew. The legend of the Wandering Jew tells of a man who insulted the Saviour on His way to Calvary, urging Him forward with curses when He sank beneath the weight of the Cross. Jesus made answer, "I go, and that quickly; but thou shalt wait till I return;" and in fulfilment of this judgment the Jew wanders over the earth, awaiting the last day.

Wanderoo, properly the name of two Slender Monkeys from Ceylon, but applied in books to the Lion-tailed Monkey (*Macacus silenus*) from the Western Ghats of India. The length is about three feet, of which the tail (tufted with white) forms about one-third; the fur is black, and round the face is a long thick fringe of whitish hair.

Wapentakes, the name given in Yorkshire to those divisions of a county called elsewhere hundreds.

Wapiti (*Cervus canadensis*), a large North American deer standing about fifty-four inches at

the shoulder. It frequents low and marshy grounds, and is much hunted for its skin, which makes excellent leather, but the venison is indifferent.

Warbler, a popular name for birds of the Passerine family Sylviidæ, from the powers of song possessed by many of them. The name now is generally confined to birds of the sub-family Sylviinæ of the Thrush family, and is often used with an epithet. These birds are generally of small size and sober plumage, for the most part alike in both sexes. British species or visitors are:—The Whitethroat (q.v.), the Lesser Whitethroat, the Orphean Warbler (*Sylvia orphea*), the Blackcap (q.v.), the Garden Warbler (*S. hortensis*), the rare Barred Warbler (*S. nisoria*), the Dartford Warbler (*S. undata*), the Golden-crested Wren (q.v.), the Fire-crested Wren (*Regulus ignicapillus*), the Yellow-browed Warbler (*Phylloscopus supereiliosus*), the Chiffchaff (q.v.), the Willow Wren (*P. trochilus*), the Wood Wren (*P. sibilatrix*), the Rufous Warbler (*Aëdon galactodes*), the Icterine Warbler (*Hypolaïs icterina*), the Reed Warbler (*Acrocephalus streperus*), the Marsh Warbler (*A. palustris*), the Great Reed Warbler (*A. turdoides*), the Sedge Warbler (*A. phragmitis*), the Aquatic Warbler (*A. aquaticus*), the Grasshopper Warbler (*Locustella naevia*), and *Savi's* Warbler (*A. luscinoides*). [HOWARD SAUNDERS.]

Warrant, WARRANT OF ATTORNEY, a precept under hand and seal to an officer to execute or carry out process of any kind according to due course of law. Warrants are used both in civil and criminal cases. In the former category may be named warrants from the sheriff of a county to his officers to execute process, warrants of distress and sale; in the latter warrants authorising the arrest or apprehension of persons charged with or suspected of having committed indictable offences, warrants to discharge from prison a person who has been bailed, warrants of commitment, etc. A warrant of attorney is a written authority addressed to a solicitor of the court in which it is intended that a judgment shall be entered up, authorising him to appear and receive a statement for him in an action brought or to be brought against him at the suit of a person named and to confess the same or suffer judgment to pass by default. It also authorises him to execute a release of errors touching the judgment.

Warranty. A warranty is an engagement or undertaking forming part of a sale or other transaction. It differs from a mere representation, as it constitutes in effect an absolute engagement on the part of the warrantor, whether made in good faith or not, and, unless it be strictly and literally performed, the contract is avoided, or he becomes liable to an action for breach of warranty, according to the nature of the transaction. Warranties are also implied in the following cases:—(1) A warranty of title will be presumed when the goods sold are at the time of the sale in the possession of the vendor or of a third person, unless the contrary be then expressed; (2) when an examination of the goods is from their nature or situation impracticable;

(3) where goods are to be manufactured or to be procured for a particular purpose, a warranty of their reasonable fitness will be presumed; (4) a warranty will be presumed against all latent defects in two cases—(i.) when the seller knew that the buyer did not rely on his own judgment, and (ii.) when from the situation of the parties the seller might have provided against defects, or where a warranty may be presumed from the very nature of the transaction; (5) where goods are sold by sample a warranty is implied that the bulk corresponds to the sample in nature and equality.

Warrington, a parliamentary and municipal borough of Lancashire, on the Mersey, midway between Liverpool and Manchester. It is mentioned in Domesday, but contains few relics of antiquity, the Saxon church having given place to a modern structure. The bridge (1496), connecting Lancashire with Cheshire, has witnessed several stubborn fights. Fustians, corduroys, sacking, sailcloth, glass, pins, and tools are the chief articles of manufacture, and the local ale has high repute. Here the first stage-coach started, and the first Lancashire newspaper was published. One member is returned to Parliament.

Warsaw, the former capital of Poland, and now the centre of the Russian province to which it gives its name, stands on the left bank of the Vistula, 320 miles E. of Berlin. Founded at an early date, it possesses a 14th-century cathedral, and superseded Cracow in importance in 1566. The old walls and gates still exist, and the city is commanded by a strong fortress built by the Czar Nicholas I. The suburb of Praga lying beyond the iron bridge is also fortified. Fine new promenades and squares have been laid out, but the ancient quarters are irregular and mean. Among the public buildings are the Sigismund Palace (16th century), the Saxon Palace, the Casimir, Brühl, and Radziwill Palaces, the university, the Greek cathedral, the Lutheran church, and several synagogues. The Greek Archbishop is the Primate of Poland. The greater part of the trade of the country is centred here, and the annual fairs are largely frequented. Cloth-weaving and the making of carpets, chemicals, jewellery, pianofortes, carriages, and machinery are the leading industries. Though Russia closed the university for many years, and exercises strict supervision over the press, intellectual life has never been quite stifled out.

War-ships are now commonly Ironclads. The system of plating ships with iron was first tried by the French in 1855, but it was not put into practice until 1858. In most cases sea-going vessels have no masts or sails, and their armour is 16 to 18 in. thick.

Wart-Hog. [PIG.]

Warwick, a parliamentary and municipal borough and county-town situated on the Avon, 20 miles S.E. of Birmingham. Dating from Saxon times, it figures in Domesday as a place of some size, and its castle, begun in the 14th century, gave it great importance in the feudal epoch. This noble structure is still the residence of the Earls of Warwick. and contains a fine collection of pictures

and armour. The parish church of St. Mary (Perpendicular), with its exquisite Beauchamp Chapel, the Leicester Hospital, and the two ancient gates, are interesting relics of the past, but most of the town is modern. It returns one member to Parliament.

Warwick, RICHARD NEVILLE, EARL OF (1428-71), the "King-maker," was the eldest son of Richard Neville, Earl of Salisbury. On the outbreak of dissensions between the Houses of York and Lancaster he joined the former faction, contributing in no small degree to its triumph in the first battle of St. Albans (1455). In the same year he was appointed Captain of Calais, but when the war was renewed in 1459 he again joined the standard of the Duke of York. In June, 1460, he landed at Sandwich and marched on London, Henry retreating before him as far as Northampton, where the royal forces were severely defeated, and the king himself fell into Warwick's hands. At the close of the year Queen Margaret was victorious at Wakefield, the Duke of York losing his life in the battle, and when Warwick endeavoured to intercept her march to London he suffered a severe defeat at St. Albans. But the rapacity of the queen's northern troops excited the indignation of the Londoners, who willingly admitted the joint forces of Warwick and the young Duke of York. The latter now became king under the title of Edward IV., and the hopes of the Lancastrians were finally crushed in the bloody field of Towton (March, 1461). In 1470 Warwick was forced to seek refuge in France. By the influence of Louis he was reconciled to Margaret, and an invasion of England in the Lancastrian interest was planned. Edward's flight to Burgundy was followed by the restoration of Henry VI., and Warwick was once more supreme. In the next year (1471), however, Edward returned and entered London, and after a hard-fought battle at Barnet, in Hertfordshire, Warwick was defeated and slain.

Warwickshire, a central county of England, occupying an area of 885 square miles, between Leicestershire N.E., Staffordshire N.W., Worcestershire W., Oxfordshire S.E., and Gloucestershire S.W. The surface is undulating and picturesque, well adapted for agriculture and grazing, whilst the timber is remarkably fine. The northern portion, once covered by the Forest of Arden, is now mainly devoted to manufactures, Birmingham, Coventry, Nuneaton, and Tamworth being the chief industrial centres. Coal, iron, limestone, and fireclay are worked in these districts. The south, to a large extent pastoral, is famous as a hunting country. Besides the towns mentioned above, there are Leamington, noted for saline waters; Stratford-on-Avon, the birthplace of Shakespeare; and Rugby, the seat of a great public school.

Wash, THE, is the estuary of the Ouse, Nen, Welland, and Witham, occupying a space some 22 miles long by 15 broad, between the counties of Norfolk and Lincoln. For the most part it consists of shoals and quicksands, dangerous alike to travellers by land or water; but the Lynn Deep and Boston Deep give anchorage for vessels of

moderate size. Much of the bed has been reclaimed in recent years.

Washington. 1. The capital of the United States. It is situated in the district of Columbia, between Virginia and Maryland, on the left bank of the Potomac, 35 miles S.W. of Baltimore. Founded in 1791, it was made the seat of government in 1800. The city is regularly laid out in wide streets radiating from the Capitol. This latter contains the chambers of the Senate and Congress and the Supreme Court, and is a fine freestone structure with an iron dome, surrounded by a park of 35 acres. The White House, the residence of the President, $1\frac{1}{2}$ miles distant, has larger grounds, and near it are the chief Government offices. The Naval Observatory, the Smithsonian Institution, and the Corcoran Art Building are handsome edifices. Howard and Columbia Universities stand in the suburbs. The city is adorned with many statues, and besides markets, theatres, etc., has an arsenal, navy yard, and accommodation for troops. There are few industries except glass-making and metallic wares, and the river trade is limited to the suburbs of Georgetown and Alexandria.

WASHINGTON. 2. A state in the extreme N.W. of the United States of America. Settled in 1845, made a territory in 1853, it was admitted to the Union in 1889. It has an area of about 70,000 square miles, being separated from British Columbia to the N. by Fuca Strait, and bounded S. by Oregon, E. by Idaho, and W. by the Pacific. Traversed inland by the Cascade Mountains and further W. by the Coast Range, its surface is very rugged. Mount Rainier attains 14,444 feet, Mount Baker 11,100, whilst Mount St. Helens, Mount Adams, and Mount Olympus are nearly as high. The Columbia and its tributaries drain a large portion of the state, but there are many other rivers on either side of the watershed. Olympia is the capital, and among the rising settlements are Port Townsend, Tacoma, Seattle, Spokane Falls, Ellensburg, and Vancouver.

Washington, GEORGE (1732-99), was born in Westmoreland County, Virginia. He was volunteer aide-de-camp to General Braddock, and fought in the disastrous battle of the Monongahela. Three years later he led the advance-guard in the capture of Fort Duquesne, which was renamed Fort Pitt (1758). He was one of the delegates sent by the Virginia Convention to the first Continental Congress in 1774, and in 1775 was appointed commander-in-chief of the forces raised by the United Colonies to resist the Mother Country. After a siege of eight months he compelled the British troops to evacuate Boston (March, 1776); but in August he was defeated by Howe in the battle of Long Island and compelled to fall behind the Delaware. The advantages gained at Trenton and Princeton (January 3) saved Philadelphia for a while, but Howe made his way round by sea. A British victory at Chads Ford (September 11) was followed by the capture of the city, and Washington suffered a second defeat at Germantown. In June, 1778, he fought an indecisive battle at Monmouth Court House. During the greater part of 1779 and 1780

he remained inactive, owing to the weakness of his army; but in 1781, having been appointed to the command of the Army of the South, he was enabled to direct the operations which resulted in the collapse of the British attack and the surrender of Lord Cornwallis at Yorktown (October 19). In 1783 he resigned his commission and returned to Virginia; but in 1787 he was elected President of the Convention which drew up the national constitution, and two years later he became first President of the United States. At the end of his second term of office in 1797 he withdrew from public affairs.

Wasp, any species of the genus *Vespidæ*. The common wasp (*V. vulgaris*) is a native of Great Britain. Sexually it is of three kinds—males, females, and neuters—the two latter armed with a venomous sting. The neuters are the workers in the hive. Most of the workers and all the males die at the approach of winter.

Waste Book, a book containing a regular account of a merchant's transactions set down in the order of time in which they took place.

Watch-making originated in the early part of the sixteenth century, when the discovery of the mainspring rendered the construction of a pocket timepiece possible. The earliest examples had a verge escapement, without a balance-spring, and never can have been made to go at all regularly, even by the addition of a fusee to equalise the force of the mainspring as it unwound. Robert Hooke discovered, about 1660, that the addition of a properly-arranged spring to the balance would make it have a definite time of vibration, and succeeding generations of watchmakers have found means of applying this discovery with astonishingly accurate results. The balance-wheel is a small fly-wheel, to the arbor of which is fixed one end of a flat spiral spring, the outer end of this spring being secured to the body of the watch. If such a wheel is turned from its position of rest and then left to itself, it will oscillate about its middle position, each successive swing diminishing in amplitude as the energy stored in the spring is used up in the friction of the pivots and in churning up the air. All these vibrations will be performed in nearly equal times, and by making the spring of a suitable shape they can be made almost exactly isochronous. The balance, therefore, provides a means for splitting up time into small equal intervals, but it is further necessary to supply it continuously with power to keep up its vibrations. This can be effected by one of the many kinds of escapements. It is found that the rate of a watch varies with changes of temperature, owing partly to the expansion and contraction of the balance-wheel, and partly to a variation in the elasticity of the balance-spring. The compensation balance is designed to remedy this evil.

Water is a mobile transparent liquid, which in a state of purity is almost colourless; when seen in sufficient bulk, however, it appears a bluish-green. This must not be confused with the intense blueness of some of the Alpine lakes, as this has been

found not to be inherent in the water, but to be due to the presence of tiny particles of matter. Water is almost incompressible; it was found that in some experiments made by the Florentine Academy, where water was enclosed in hollow spheres of gold and silver, that the liquid oozed through the metal rather than be compressed. Later experiments, however, show that 1,000,000 volumes are diminished by 50 under a pressure of two atmospheres. Hence an ocean six miles deep has its surface lowered 620 feet by the compression due to its own weight, and the average sea-level is lowered 116 feet over the earth. Hence 2,000,000 square miles of land are now uncovered which would be submerged if water were incompressible. Water is an extremely bad conductor of heat; a piece of ice compelled to rest at the bottom of a thin glass test-tube full of cold water will remain unmelted for a long time, even though the tube be heated in the middle till the upper half of the water gets quite hot. Water heated at the base transfers its heat to the surface by means of *convection* currents, the heated particles of liquid rising on account of their diminished density. Absolutely pure water is never found in nature, the nearest approximation being rain-water which has been collected during a heavy shower some time after its commencement. Water is separated from suspended impurities by filtration, but is only got quite pure by distillation. [STILL.] Distilled water is extremely insipid to the taste, on account of the absence of air.

Water contracts on cooling till the temperature of 4° C. (39° F.) is reached; then it commences to expand, and continues doing so down to 0° C., at which point it freezes, and then further expands, so that 100 volumes of water become 109 volumes of ice. This sudden increase of volume causes the bursting of water-pipes, and plays a very important part in nature by disintegrating the rocks and soil. When ice is melted, a certain amount of heat is absorbed in the process without causing a rise in temperature. This is known as the *latent heat* of water, and is equal to 79.25 units of heat. [ICE.] A corresponding amount of heat is also absorbed when water is converted into steam, the latent heat of the steam at the boiling-point being 536 heat units. A curious effect can be obtained by sprinkling a few drops of water on to a very hot plate. They are found to assume a spheroidal shape, they do not touch the plate and they do not boil away; but if the temperature is allowed to fall, the drop begins to boil, touches the plate, and then suddenly bursts into steam and vanishes. This is known as the *spheroidal state*, and was investigated by Leidenfrost. Other liquids besides water will exhibit the same phenomenon.

Water is one of the best solvents known, and the solubility of almost all substances is greater in hot than in cold water. The presence of water in many salts alters their crystalline forms; this is known as "water of crystallisation," and its presence to a greater or less amount frequently alters the colour as well. Thus some almost colourless substances will assume a much darker tint if heated, so that they lose some of their water. Many such substances are used as "sympathetic inks."

Liquid water at 4°, its point of maximum density, is taken as a standard for the measurement of specific gravity. Steam, however, is not the standard for gases, and its density [VAPOUR DENSITY] is nine times that of hydrogen.

Water-Bears, or BEAR ANIMALCULÆ, are the members of the Tardigrada or group of Arachnida, allied to the Acarina or Mites. The group is characterised by having four pairs of short limbs, and no abdomen. They are minute in size, have a soft, cylindrical or elongated oval body, a pair of eyes, and jaws adapted for piercing and sucking. *Macrobiotus* is a typical genus. They live in damp moss, pools, and in the gutters of houses.

Water-Beetles are the insects belonging to the family *Dytiscidæ*, and are common in fresh-water pools.

Water-Brash. [INDIGESTION.]

Water Clock was used by the Greeks and Romans as a simple instrument for measuring time. Though not of such antiquity as the sundial, it, nevertheless, was used in the earliest times, and in Babylonia and Egypt formed the clock of the astronomers. In B.C. 145 Ctesibius of Alexandria improved the water clock by adding to it a system of wheels; these moved a small figure which pointed out the hours.

Water-Colours are pigments which for use are ground up with water, a little gum or gelatine being added, if necessary, to give a required consistency. The colours are usually far more transparent than oil-colours, and used in a totally distinct fashion. For storing they are usually kept as hard cakes, or mixed with water and a little gelatine in collapsible tin tubes. [PIGMENTS.]

Watercress (*Nasturtium officinale*), a British creeping perennial aquatic member of the order Cruciferae (q.v.), valued as a pungent salad plant, appetising and antiscorbutic. The South American *Tropæolum* (q.v.), known as "Nasturtium" in gardens, is in no respect related to it, save in flavour. The water-cress has smooth, shining, pinnate leaves, with seven to thirteen ovate leaflets, the terminal one considerably the larger. The flowers are small, white, and in a corymbose raceme, and the stalks are hollow.

Waterfall. A true waterfall is to be distinguished from a *water-slide*, where the river merely dashes down a steep slope without ceasing to be in contact with the ground, and from a *cascade*, where a mountain-torrent leaps over a pre-existent rock-ledge; for the true waterfall is probably always the work of the river itself, which, passing from one rock on to the outcrop of a softer one, wears away the latter more rapidly. A ravine or gorge is thus formed, with the fall at its head, and this fall will, by the erosive action of the river, retreat steadily up stream. The swirl of water below the fall frequently hollows out a pool and leaves a projecting ledge, over which the water dashes until it breaks away. The "chines," "glens,"

or "bunnies" of our south coast present good miniature examples of the formation of waterfalls.

Water-Flea, the popular name for *Daphnia* (q.v.).

Waterford, a county and its capital in the province of Munster, Ireland. The former has an area of 721 square miles, and a coastline of about 50 miles, deeply indented by the harbours of Waterford and Dungarvan, and the bays of Tramore and Youghal. The Cummeragh and Knockmealdown Mountains, with the Drum Hills, cover two-thirds of the surface, but the land is level and marshy to the E. The breeding of cattle and swine and dairy-farming are the chief industries, butter and bacon being largely exported. The city of Waterford stands on the Suir, 6 miles above its confluence with the Barrow, the estuary forming a splendid haven 15 miles long by 2½ broad.

Water-Hen. [MOOR-HEN.]

Water-Lilies, a general term practically including the whole of the thalamifloral Natural Order Nymphaeaceæ, i.e. some sixty species belonging to eight genera, which inhabit the waters of temperate and tropical regions. They are perennial, with a starchy rhizome embedded in the mud, and leathery, orbicular, involute leaves, often floating and sometimes peltate. Both petioles and peduncles contain large air-spaces with remarkable internal hair-cells. The sepals, petals, and stamens of the large, beautiful, and often fragrant flowers are all free and hypogynous, and frequently exhibit very gradual transitions from the one to the other. They have several carpels, generally surrounded by a fleshy adnate disk, with radiate stigmas and ovules scattered over the inner surfaces of the ovarian chambers. The seed has both perisperm and endosperm, separated by a persistent embryo-sac, which was at one time mistaken for a cotyledon, and so led to the order being considered monocotyledonous. The flowers may be white, yellow, pink, or blue. *Castalia speciosa*, the white water-lily, and *Nymphaea lutea* and *N. pumila*, the yellow water-lilies, are British.

Water-Mites, a family of Acarina (q.v.) known as the *Hydrachnida*, the members of which are parasitic on water-beetles.

Water-Power. [HYDRAULICS.]

Water-Pressure. [HYDRAULIC PRESS.]

Water-Scorpions are the members of the family *Nepidae*, belonging to the class of insects known as Heteroptera (q.v.). They obtain their popular name from the facts that the pair of front legs are jaw-like in appearance and are kept in advance of the head, and from the possession of a long pointed tail, so that they somewhat resemble scorpions. They live in pools, and are often 2 to 3 inches long. The type-genus is *Nepa*.

Watershed, or WATER-PARTING, the dividing-line between the drainage-areas or basins of two rivers. This line is very often a ridge of high ground, but not necessarily so. Several of the largest rivers in Europe—those of Russia—radiate

from swampy ground but little elevated above sea-level; nor is the central watershed of North America very elevated. The rivers of the south of Ireland and those of the south-east of England cut ravines through ground higher than their present sources. This is due to alterations in the levels of the land by subaërial denudation since the rivers began to flow in their present courses.

Waterspout, a violent gyration of air or tornado occurring over the sea, in which atmospheric pressure is so reduced that the sea is violently agitated and heaped up, whilst the black cloud overhead projects downward like an inverted cone. As the central column of air is further rarefied its moisture is condensed as water, thus completing the column. Tornadoes originate after calm sultry weather, when the air is very moist. They gyrate in a direction opposite to that of the hands of a watch, and travel—in an easterly, generally north-easterly, direction—at rates varying from 12 to 60 miles per hour, with a path from 13 to over 3,000 yards wide, and with a deafening noise. The damage done by them on land is largely owing to the explosion of buildings from the rarefaction of the air surrounding them.

Watt is a unit of rate of doing work, and is equal to $\frac{1}{746}$ horse-power. It is found a convenient unit by electricians, as it expresses the rate at which work is done by a current of 1 ampère flowing in a circuit of 1 ohm resistance; so that the power developed in watts in any circuit is obtained by multiplying the current in ampères by the difference of potential in volts. The power expended in a glow-lamp, for instance, is said to be, say, 60 watts; and in the case of dynamos, where the numbers would be inconveniently large, the kilowatt (= 1,000 watts) is often used. One watt is equivalent to 10^7 ergs in the C.G.S. system.

Watt, JAMES (1736–1819), civil engineer, was the son of a merchant at Greenock, where he was born. His education was much interrupted by ill-health, so that his knowledge was mostly self-acquired. His weakly constitution also prevented his remaining in London, where he had become apprenticed to a mathematical-instrument maker in his nineteenth year. Baulked by the jealousy of the incorporation of hammermen in his design of settling in business at Glasgow, he secured the patronage of the university professors, who in 1757 made him mathematical-instrument maker to the university. In 1763, however, he established a business of his own. Entrusted with the repair of a model of Newcomen's engine, he devised the expedient of the separate condenser, thereby economising steam and fuel (1765), and went on to substitute steam for atmospheric pressure as the motive-power by making the former act directly on the piston introduced into the cylinder. In 1774 he entered into partnership with Matthew Boulton, owner of the Soho Engineering Works near Birmingham. His further improvements included the crank and fly-wheel, the double-acting principle, parallel motion, the smokeless furnace, and the regulating action of the governor.

Wattle, the fleshy lobe that grows under the throat of the domestic fowl.

Wattle. [ACACIA.]

Watts, ISAAC (1674–1748), was the son of a Dissenting minister. In 1698 he was chosen assistant to Dr. Chauncey, minister of the Independent Church in Mark Lane, whom he succeeded in 1702. His name endures as the author of *Horæ Lyricæ*, *Hymns and Spiritual Songs*, and *Divine and Moral Songs for Children*.

Waves and Wave-Length. Wave motion is such that consecutive particles in the medium through which the wave is passing undergo, one after the other, a similar series of movements, each particle coming to rest when the wave has passed it. There is thus no transference of matter along the wave, but only transference of motion. It is seldom that we are able to deal with a single wave; generally a number of waves succeed each other, the particles repeating their series of movements for each fresh wave which passes it. Sea-waves are formed in the above manner, but particles may move in many other than circular paths, the form of the wave naturally differing in consequence. If the path is reduced to a straight line at right angles to the direction in which the wave is travelling, we have what are called transverse vibrations, and the particle is moving with a simple harmonic motion. [HARMONIC MOTION.] If the path be a straight line in the direction of the wave, we have again simple harmonic motion, but the vibrations are known as *longitudinal*. Longitudinal vibrations are of interest, since sound is transmitted by them through matter. In this case the waves do not appear in the familiar form of crests and troughs, but are shown as successions of compression and rarefactions. [SOUND, Fig. 2.] Transverse vibrations are important in the study of the transmission of light and other radiations through the ether. If a particle be made to move under the action of two or more simple harmonic motions its path can be quite simply found, and the shape or the curve so obtained depends on the period of each oscillation, on the amplitude, and on the difference of phase. In this way an infinite variety of curves can be obtained, representing the resultant motion of a particle, and many instruments, known as harmonographs, have been constructed to actually draw the curves.

Wax is used to denote a large number of substances all more or less allied in their properties and chemical composition to beeswax (q.v.), as *e.g.* Chinese wax, spermaceti (q.v.), etc. They are all solid bodies, fairly hard when cold, but softening when warmed, and melting below or near 100°. In their chemical composition they are organic ethereal salts, *i.e.* compounds of organic salts with alcohols, both acid and alcohol being usually rather complex and containing many carbon atoms in the molecule. They are obtained chiefly from vegetable sources, and are much used in making candles, fancy articles, toys, etc., and in medicine as an emollient.

Wax-Bill (*Estrela astrilda*), a small South African finch, a favourite cage-bird.

Waxwing, any of the three species of the Passerine genus *Ampelis*. The secondaries, and sometimes other feathers, end in horny expansions like pieces of red sealing-wax. The Bohemian Waxwing is *A. garrulus*, and the Japanese Waxwing *A. phænicoptera*. [CEDAR-BIRD.]

Waxy Degeneration. [AMYLOID DISEASE.]

Ways. There are four kinds—

1. A footway.
2. A horse and footway, called also a pathway.
3. A cartway (including foot and horse way).
4. A driftway, *i.e.* a way for driving cattle.

Ways are either public or private, the former being open to all subjects of the realm, the latter open only to the inhabitants of a particular parish, village, or house. A public way is also commonly known as a highway. It is commonly assumed that every highway is the sovereign's, but this means that the sovereign and his subjects have at all times the right to pass and repass only at their pleasure, for the freehold and all the profits thereof belong to the lord of the soil, being generally the adjoining owner, who, therefore, may maintain trespass for digging in the highway. A public way need not be a thoroughfare, nor is a thoroughfare of necessity a public way. The dedication of a public way is readily presumed from user as such, *e.g.* from eight to six years' user. But a highway may also exist by express grant. It most commonly exists in virtue of some Act of Parliament.

Wealden Beds, a great series of mainly fresh-water beds, some 1,900 feet thick, belonging to the Lower and Middle portions of the Neocomian or Lower Cretaceous (q.v.) system, which take their name from the Weald, or ancient forest area, of Sussex, Surrey, and Kent. These beds extend from Poole in Dorsetshire and Brook in the Isle of Wight, under both South and North Downs, to the Boulonnais, and probably represent the delta deposits of a great river coming from the north and west. They pass insensibly downwards, as in the Battle, Fairlight, and Purbeck areas, into the underlying Purbeck beds (q.v.), and upwards, with but little break, into the Atherfield Clay, the lowest division of the marine Lower Greensand (Upper Neocomian) series. The entire series is subdivided into the *Hastings Sands* and the *Weald Clay*, and between the North and South Downs, where the whole Cretaceous system is in an anticlinal fold, not only the once-overlying dome of Chalk, but in the centre of the area the Weald Clay also, has been removed, thus exposing the Hastings Sands in the undulating woodland region of St. Leonards and Ashdown Forests. The Hastings Sands is subdivided into—

Upper Tunbridge Wells Sand.
Grinstead Clay.
Lower Tunbridge Wells Sand.
Wadhurst Clay.
Ashdown Sand.

It was in these beds that iron-ore was formerly extensively worked in Sussex and adjoining districts.

Weasel (*Mustela vulgaris*), a common British carnivorous mammal of the same genus as the Stoat.

The total length is rather under a foot, of which the tail counts for about a third. The fur is reddish-brown above and white beneath; but in cold countries the whole pelage becomes white in winter. Weasels feed on mice, rats, small birds, and frogs.

Weather. It was not until recent times that the old-fashioned "signs" received any scientific explanation, for the science of meteorology is of recent growth. Within about thirty years the use of "synoptic charts" has much facilitated the forecasting of weather. On these charts the height of the barometer is recorded at a specified time in a number of places over a large area. Lines are drawn through places of equal barometric pressure, and are known as isobars. Isothermals are also drawn through places of equal temperature, while arrows indicate the direction and force of the wind, and other symbols are used to denote the appearance of the sky, the kind of clouds, the occurrences of mist, rain, or snow, and other important details. From a study of such charts it has been found that the wind always blows in a particular direction with regard to the position of minimum pressure, and its force is greater the nearer the isobars are together. The isobars have also been found to group themselves into about seven fundamental shapes, and each shape brings its own particular kind of weather—mists, rain, clouds, blue sky, and so on. The whole isobaric areas are constantly moving onwards, so that place after place enjoys the same succession of weather detail. Hence, if we can tell—as in many cases we can—which way such an area travels, we can predict with some certainty the weather of different places in its path. Perhaps the two best-known isobaric shapes are the cyclone and anti-cyclone—the one being the exact reverse of the other. In a cyclone the isobars are closed oval curves, the outer one showing a higher pressure than the inner one. As it moves onwards places in front of it have a falling barometer, and in its rear the barometer rises. The line joining places whose barometers have all just recorded their lowest points is called the "trough" of the cyclone. Roughly speaking, in the northern hemisphere the wind blows round the centre of the cyclone in a direction opposite to that of the hands of a watch. All places in front of the cyclone's trough get muggy weather, gloomy sky, stratified clouds, and possibly rain; all behind the trough have a clear sky, cool fresh air, and the clouds are of the heavy cumulus type. Near the centre of the cyclone is rain or drizzle; at the front there is seen a pale moon and watery sun, always considered as foreboding bad weather, and we now see why. The front of a cyclone also showing a falling barometer, we see why the latter is taken as a sign of rain. What sequence of weather will pass over a place is determined by the position the place occupies in the cyclone, and the direction in which the latter is moving. It may enjoy all the variety which the cyclone is capable of giving, or may merely have a few effects near the edge. Sometimes a cyclone is followed by a "secondary cyclone," and in this

case the blue sky following the former is rapidly clouded, and a steady downpour of rain sets in, little change being shown by the barometer. The centre of an anticyclone is an area of *high* pressure, the surrounding isobars being almost circular and far apart. An anticyclone is generally stationary for some time, the air being cold in the centre, and winds circulating in the outer portions in the same direction, in the northern hemisphere, as the hands of a watch. In summer the central part of an anticyclone is characterised by a hot sun, heavy dew, mist, and calm; while in the winter the mist and calm give rise to fog. An anticyclone, on account of its steadiness, means settled good weather, but east winds prevail to the south of it.

Weathering, the geological term for the combined effect of atmospheric action upon rocks. This action consists chiefly in (1) sudden changes, or rapid alternations of, temperature, such as those between day and night in extremely continental climates; (2) alternate saturation by rain and desiccation by sun; (3) frost; (4) surface evaporation in rainless areas; (5) hydration by atmospheric moisture; (6) the mechanical action of rain; (7) the erosive action of blown sand; and (8) the action of atmospheric carbon-dioxide. The first of these splinters hard rocks by alternately expanding and contracting them. The second specially disintegrates shales and clays. The third is one of the most important weathering agents, as it causes the interstitial water of surface rocks to expand 10 per cent. The fourth action results in the formation of the saline efflorescences characteristic of those areas. The fifth shows itself in the rust-stains on rocks containing iron and in the conversion of anhydrite into gypsum (q.v.). The sixth, an important and obvious agency, besides its everyday action seen in turbid streams and accumulations of rain-wash, has formed the curious earth-pillars of the Tyrol and elsewhere. The eighth action is seen in the effacement of inscriptions on limestone, in the hard water and red clay residue in limestone areas, and in the rotting of the felspar of granite.

Weaver-Bird, a popular name for any species of the Passerine family Ploceidæ, finch-like birds, found in the warmer parts of the Old World, and absent from Europe and America. Their popular and scientific names refer to their manner of constructing their nests. The plumage of the males is brilliant. The Baya Weaver-bird (*Ploceus baya*), a well-known Indian species, builds a nest something like a retort with the bulb uppermost, the entrance being at the bottom. There is a second chamber, and the structure is generally fixed to the branches of trees, often over water. The Social Weaver-bird (*Philhæthus socius*), from Africa, builds in company. A roof-like structure is made in a tree by a number of these birds working together, and under this the nests are made side by side, like the cells of a honeycomb. The Mahali Weaver-bird (*Ploceus taha*) is said to defend its nest with thorns pointing outwards.

Weaving is the art of making cloth by the intersecting of two sets of threads. The threads or

yarns which run parallel to the length of the cloth are known as the warp, and the weft intersects these at right angles. The warp threads are wound up on a cylinder known as the warp-beam, which works in bearings in the frame of the loom, and are drawn off as required. Each of these threads is passed through an eye in a "heddle," which is a frame supporting a number of such eyes. There are at least two heddles, alternate threads being passed through the eyes of each. The heddles may be raised or lowered by treadles in the case of a hand-loom, and the act of raising one lowers the other. Alternate threads can thus be lifted up or depressed as required. Near the heddles is a "reed," consisting of two bars joined by a number of flat strips of metal; the warp threads pass between these strips. The weft is wound in a shuttle, and this can be thrown across the loom immediately in front of the reed and between the two sets of warp threads when the latter are held apart by the heddles. A weft thread is thus introduced alternately under and over the warp threads, and if the position of the two heddles is now reversed and the shuttle again thrown, a second thread will be placed over and under those threads which it was previously under and over. At each throw of the shuttle the reed is brought forward, and pushes each new weft thread close up to the last. The cloth, as it is made, is wound up on a second roller or "cloth beam." Such a loom suffices for making plain cloth, such as calico, but no patterns can be produced save those due to the use of various coloured threads, which are limited to simple stripes. To produce more complicated patterns the warp must be divided into more than two portions, necessitating a number of heddles; then variations from the simple alternate crossings of the threads are possible. All the movements of a loom may be, and until recent years were, performed by hand; but now automatic devices, operated by steam or other power, are applied to throw the shuttle, move the reed, and wind up the cloth, in addition to working the Jacquard apparatus. In making some fabrics the warp threads are half-twisted round each other in alternate directions between each passage of the shuttle, whereby a gauze is produced. In the case of piles wires are introduced at intervals between the warp threads, which, being subsequently withdrawn, leave a series of loops. These loops are cut in the case of velvets, etc.

Weber, KARL MARIA FRIEDRICH ERNST VON (1786-1826), German composer, was a native of the duchy of Holstein, and was of musical family. He received the best part of his musical training from Henschkel, of Hildburghausen; Michael Haydn, of Salzburg; and Kalcher of Munich; and at the age of twelve produced an opera and other music showing remarkable promise. In 1800 he composed another opera, *Das Stumme Waldmädchen*, which was performed with fair success at Munich and other cities. After completing his training in Vienna, he became conductor of the opera at Breslau, and during his tenure of the position composed various works which enhanced his already good reputation as a musician. In 1813 he was

appointed director of the opera at Prague, and whilst there wrote his famous melodies for Körner's songs and other things equally good. Obtaining the directorship at Dresden, he went there about 1816, and there produced his greatest works, *Der Freischütz* (1822), *Preciosa* (1822), and *Euryanthe* (1823), and died after *Oberon* was brought out. His writings for the pianoforte are admirable and deservedly popular.

Webster, DANIEL (1782-1852), American orator, was born in New Hampshire, where his father was a farmer. He worked on the farm during his boyhood, but was in later years enabled to attend an academy, and in 1797 entered Dartmouth College, from which he graduated in 1801. In 1805 he was called to the bar, and began to practice, at first at Boscawen, but later in Portsmouth, New Hampshire. He almost at the same time entered public life as a politician, speaking at meetings and strongly supporting the Federalists. In 1812 he entered Congress, where his great eloquence made him one of the leaders of his party. He settled in Boston, of which he became one of the most notable lawyers. In 1820 his great speech on the Pilgrim Fathers, and in 1823 his oration on the Greek Revolution, established his right to be considered the foremost orator in America. In 1827 he was named a member of the Senate, and in 1830, in conjunction with Henry Clay, he formed the Whig Party which held a tremendous sway in American public affairs for so many years. From 1841 to 1843 he was Secretary of State, and almost secured the Presidency on two occasions.

Webster, JOHN, one of the greatest of what are called the Elizabethan dramatists, by virtue of his extremely fine and powerful play, *The Duchess of Malji*, is still a mystery to the literary historian, so far as his biography is concerned. Scarcely anything whatever is known of his life beyond that he was clerk to the parish of St. Andrew's, Holborn. He published his first play, *The White Devil*, in 1612, his only previous writing having been done in conjunction with other dramatists. *The Duchess of Malji* first appeared in 1616, but was not published till 1623. In 1654 his *Appius and Virginia* was brought out, and it is probable that Webster died soon after.

Wedge is a solid body which is thinner at one end than the other. If the thin end be inserted into a fissure in a rock, for instance, force applied at the thick end drives the wedge farther in, enlarges the crack, and so splits the rock into two. In investigating the ratio between the actual force applied and the resistance overcome, it is usual to consider that both wedge and rock are perfectly smooth—an impossible case. In practice these conclusions are much modified owing to friction, especially in the case of a long thin wedge, such as is generally used. This, of course, reduces the efficiency of the machine. In engineering taper pins and "keys" are wedges so constructed that the friction is sufficiently great to retain them firmly in place. Pins, needles, chisels, choppers,

axes, and many other sharp-pointed instruments are common forms of wedges.

Wedgwood Ware. The first Wedgwood ware may be regarded as formed in 1759, when Josiah Wedgwood, after much laborious work and experiment, succeeded in manufacturing a white or cream-coloured ware, with a fine lustre, and capable of withstanding sudden heat. It obtained him the title of "royal potter," and was known as queen's ware. He, however, perfected the manufacture of pottery to a much greater extent, and after the discovery of several fine coloured or white wares, he succeeded in obtaining the well-known and prized jasper ware, for which he was chiefly famous. This was a beautiful delicate ware, which could, by the addition of various metallic oxides, be coloured throughout its whole mass. By means of this ware he produced imitations of many gems, cameos, and intaglios, pure white reliefs being obtained upon the coloured base. He also rediscovered the long-lost art of painting upon ware, so that the resulting product did not possess the usual glossy surface. To the high technical excellence and beauty of the ware the manufacturer ensured a high degree of artistic excellence by obtaining the co-operation of the artist Flaxman and the careful selection of skilful workmen. His works were situated at the village of Etruria, and this word is added to the usual mark "Wedgwood" upon the ware.

Weever, a genus (*Trachinus*) of Acanthopterygian fishes, of which two, the Greater (*T. draco*) and the Lesser Weever (*T. vipera*), are British. They are sometimes called Sting-fishes, from the fact that they can inflict severe wounds with the grooved spines of the dorsal fin and gill-cover.

Weevils, a section of beetles known as the Rhynchophora, characterised by having the body cylindrical, the head prolonged into a point or rostrum, and intensely hard horny wing-covers or elytra. The weevils are usually small, inconspicuous beetles, and there is a very large number of species of them, which are grouped into three families. One of the best-known members of the group is *Balaninus nucum* (Linn.), the Nut Weevil. The grub of this is small and white, and lives in nuts and acorns; the beetle is black with red legs, and is about a quarter of an inch in length. The Corn Weevils are the most destructive; they are about half the size of the nut weevil. The grubs live in corn grains, and they reproduce so rapidly that they commit serious depredations in granaries. *Calandra granaria* and *C. oryzae* are the two best-known species. The Pea Weevil (*Bruchus pisi*) is another familiar species. The largest and most beautiful members of the group are the Diamond Beetles. Some of these are over an inch in length. The most beautiful species, and one which is familiar as a microscopic object, is *Entimus imperialis* (Forst.) of Brazil.

Weight is the force which, acting on a body, tends to make it fall to the earth. When a body falls freely, it gains in every second a velocity of about 32 feet; hence, if we take as

our unit force that force which generates in one pound an acceleration of one foot per second, the weight of a pound will be thirty-two times this unit, or thirty-two poundals. The acceleration due to gravity is not the same at all points on the earth, it being greater at the poles than at the equator. The weight of a pound is thus not always 32 poundals, but depends upon its position; so also the weight of a gramme may vary between 978 dynes at the equator to 983 dynes at the pole. It is thus seen, that whereas the *mass* of a body is a perfectly unalterable thing, its *weight* is something which depends on circumstances. At the same spot the masses of two substances are proportional to their weights; hence we can correctly say that the mass of one substance is equal to that of another when their weights are the same as indicated by an ordinary balance.

Weights and Measures were undoubtedly in use from the very earliest times. Before the Conquest the standard of weight was the pound, known later as the "tower pound," and this remained as one of many pounds in use till it was abolished as a legal weight at the Mint by Henry VIII., who legalised Troy weight (q.v.) for the weighing of gold and silver. The commercial pounds of early days became gradually superseded by the avoirdupois pound, of which Edward III. had a standard; and our pound of the present day is practically equivalent to that standard, although intermediate standards have been made by Henry VII. and Elizabeth. The standards made in 1588 are still in existence, and were used till 1824. The old standards of capacity—the bushel and gallon—varied from reign to reign, and were all abolished as standards in 1824, when the Imperial gallon was made to contain 10 lbs. of pure water. In 1758 a Committee of the House of Commons was appointed to consider the weights and measures of the land. They caused a new standard yard and pound Troy to be made in 1760, but none of their suggestions were carried into law till 1824. In this year the two standards which had been put aside were legalised as the "Imperial standard yard" and "Imperial standard pound Troy." They were, however, left in the House of Commons, and were destroyed by fire in 1834, and a Commission was appointed in 1843 to consider their restoration. In 1854 the Commission presented its report, and new standards were made. The yard was redetermined, but the new standard of mass was now the pound avoirdupois instead of Troy, and it was to weigh 7,000 grains in vacuo, whereas the pound Troy had weighed 5,760 grains in air. The new standard pound avoirdupois was made of platinum, and was constituted the new Imperial standard pound. The Imperial yard was registered on a bronze bar, the distance between two scratches on gold plugs indicating the actual yard. In 1855 the Imperial standards were deposited in the office of the Exchequer. When the Standards Department was created, the Imperial standards were given over to the care of the Warden of the Standards. Parliamentary standards—copies of the Imperial—are kept at the Royal Mint, Royal Society, Royal

Greenwich Observatory, and in the New Palace at Westminster.

Weimar, the capital of the Grand Duchy of Saxe-Weimar, is picturesquely situated in a hilly district, on the left bank of the Ilm, 13 miles E. of Erfurt. Goethe, Schiller, Herder, and Wieland made their homes here. The opera-house and theatre still retain much of their old prestige. The Grand Ducal library contains 140,000 volumes and many objects of interest.

Weismann, AUGUST (b. 1834), biologist, became in 1860 physician to the Archduke Stephen of Austria. In 1882 he published his celebrated *Studies in Theory of Descent*. [HEREDITY, DARWINISM.]

Welding is the union of two pieces of metal by hammering or pressing together. The capability of being welded is possessed by but few metals. Iron at a red heat passes into a soft state at which it can be readily welded by pressure, a property of the utmost importance in the working of iron, and hence in the general industries, as without it the manufacture of many parts of machinery, etc., would be almost or quite impossible. Lead and gold finely divided may, without heat, be welded into a coherent mass, and platinum also at a high temperature is worked by welding. Within recent years various modes of electric welding (q.v.) have been employed.

Wellesley, RICHARD COLLEY, MARQUIS (1760–1842), statesman and administrator, was the elder brother of the Duke of Wellington, and was born in Dublin. He received his education at Eton and Cambridge, and was noted for his skill as a Latin verse-writer. Entering Parliament, his capacity soon procured him several good posts, and in 1797 he was appointed Governor-General of India. His services to England in this post proved him one of the greatest administrators ever sent to India. He afterwards became Foreign Secretary and Viceroy of Ireland.

Wellington, a province and its capital in the North Island of New Zealand. The former has an area of about 12,000 square miles, traversed by hills from 500 to 1,000 feet high, enclosing wooded valleys. The soil and climate are well adapted both for agriculture and pasture, and wool, wheat, cattle, and other produce are exported. The chief rivers are the Wanganui, Rangitiki, Manawatu, and Otaki. The country was first settled in 1840. The city stands on the shores of Lambton Harbour, opening into Cook's Strait. It has good accommodation for vessels of the largest size, and is in communication with the chief home and colonial ports. Since 1865 it has superseded Auckland as the capital of the whole of New Zealand.

Wellington, ARTHUR WELLESLEY, DUKE OF (1769–1852), was born at Dangan Castle, Co. Meath, being the third son of Garrett Wellesley, afterwards the Earl of Mornington, an excellent musical composer. He was first sent to a private school in England, and thence to Eton, finishing his studies in France. In 1787 he entered the army as an

ensign, and was promoted to the rank of lieutenant within a year. His first regiment was the 73rd, from which he exchanged successively into the 76th, 41st, and 12th Light Dragoons, etc. In 1793 he became a lieutenant-colonel in the 33rd by purchase, and was on the highroad to further promotion. But politics claimed some of his attention for a few years. He was elected M.P. for Trim in the Irish House of Commons in 1790, but made no particular mark in that assembly of brilliant speakers. He was sent to the Low Countries in 1794, and saw some fighting there, but was so disheartened by the British reverses there that he was about to leave the army; but other expeditions fortunately encouraged him, and he went to India, where he distinguished himself greatly in the struggle with France, and took a prominent part in the storming of Seringapatam. His brother Richard was at that time Governor-General, and it was mainly through his influence, perhaps, that the future duke obtained a chief command in the Mahratta War. He gained such splendid victories over the enemy that he was made K.C.B. and Major-General, and in 1805 came back to England with considerable military prestige. In 1806 he married the third daughter of the Earl of Longford, to whom he had been betrothed since his aide-de-camp days in Ireland, and in the same year was elected M.P. in the Imperial Parliament, being appointed Chief Secretary for Ireland in 1807. The great and final contest with Napoleon now commenced, and Wellington was destined to go through it with exceptional glory. In July, 1808, he left Ireland for Portugal, and later in the year inflicted several defeats on the French, notably at Vimiera. In 1809 he was made commander-in-chief of the Peninsular army, and in May of that year forced the French to leave Oporto, and repulsed them with great loss at Talavera. Successively securing Busaco, Almeida, and Ciudad Rodrigo, after determined resistance, he finally captured Badajoz, and by this series of exploits practically destroyed the French occupation of Portugal. The French were again utterly routed in July, 1812, at Salamanca, and in June, 1813, at Vittoria, when he was gazetted Field-Marshal. He then drove them out of Spain, defeating Soult at Toulouse just as Napoleon (q.v.) abdicated. He was then made Duke of Wellington and Marquis of Douro. On Napoleon's escape from Elba he was given command of the English army, and defeated him at Waterloo June 18th, 1815. In 1827 he became titular Commander-in-Chief, and in 1828 Prime Minister. He granted Catholic Emancipation, but strongly opposed Parliamentary Reform. After the resignation of Peel's Cabinet in 1835, he took little part in politics, but supported the abolition of the Corn Laws. Dying September 14th, 1852, he was buried in St. Paul's Cathedral.

Wellingtonia. [SEQUOIA.]

Wells, a cathedral city and municipal and parliamentary borough in Somersetshire, 15 miles S.W. of Bath, at the foot of the Mendip Hills. It derives its name from the hot springs in its neighbourhood, and sprang up early in the 8th century around the collegiate church. The noble Early

English cathedral was founded a few years later, but not completed until 1239, the west front, in Gothic style, being enriched with many statues. The episcopal palace is an ancient castellated structure surrounded by a wall and moat. In 1088 the see was united with Bath.

Wells, Artesian. [ARTESIAN WELLS.]

Welwitschia mirabilis, one of the most remarkable of plants, discovered by the Portuguese botanist Welwitsch in the loose sand of Benguela, from 300 to 400 feet above the sea. It has since been found at Mossamedes and near Walfisch Bay, a rainless area; so that its latitudinal range is from 14° to 23° S. It belongs to the Gnetaceæ, a small order of Gymnospermia (q.v.). It has a branched tap-root, two cotyledons, and an enormously-enlarged obconic, flat-topped, woody, epicotyledonary axis, which bears only two foliage-leaves and short marginal flowering-branches bearing cones. The stem forms a saddle-like mass not over a foot high, but sometimes 5 or 6 feet across; while the two persistent leaves grow into leathery thongs 6 feet in length, torn into strips by the wind, and trailing on the sand.

Wend, originally a general name of the Slav race (q.v.), now restricted to a small group of the Polabish (Elbe) Slavs, still surviving in Upper and Lower Lusatia (Prussia and Saxony), where they are completely surrounded by populations of German speech. In 1890 they numbered about 130,000, but are being slowly Germanised.

Werewolf (*i.e.* a manwolf), a sorcerer supposed to have the power of assuming the shape of a wolf, at the same time putting on wolf-like nature and habits, feeding on human flesh, and sometimes tearing up dead bodies from the grave and devouring them. This transformation was said to be effected by the sorcerer anointing himself with a magic salve, or putting on an enchanted girdle.

Wesley, CHARLES (1708–88), hymn-writer, was born at Epworth, and was associated with his famous brother in the earlier years of Methodism. He received his education at Winchester and at Oxford, and while he did not do any of the more arduous work in connection with the Methodist movement, he served the cause very greatly by his hymns, which were printed in the collection brought out by John Wesley and adopted by the sect, and are still very popular. One of his sons, SAMUEL (1766–1837), was a distinguished composer.

Wesley, JOHN (1703–91), founder of the English Methodists, born at Epworth in Lincolnshire, of which his father was rector, was first sent to the Charterhouse, and passed thence to Lincoln College, Oxford, of which he became a Fellow. After his ordination he was for a short period his father's curate, but, leaving that, went to Oxford again, and there co-operated with his brother Charles in a society started by the latter for the study and dissemination of religious principles. This may be considered the beginning of Methodism. In 1735 the brothers went to Georgia, where they

laboured with great zeal and efficiency for about three years. John Wesley allied himself to some extent with the Moravians, and kept up his connection with them for a couple of years after his return from America, which happened in 1738; but in this latter year he felt himself irresistibly impelled to what is known as Methodism. He travelled about the English counties, preaching fervently, and was at first not very strongly opposed, but at last the Established Church began to see the perils of the active propagation of his doctrines, and he met with severe opposition. Then he formed his followers into a distinct sect, and in May, 1739, the earliest Methodist chapel was founded. It is computed that from this date to his death he travelled about 225,000 miles, preaching more than 40,000 sermons. His following increased rapidly, and were soon numbered by the tens of thousands.

West Australia, formerly Swan River Settlement, is the largest of the Australian colonies, embracing an area of over a million square miles, and including all that part of the continent which lies W. of 129° E. long. The coast-line of 3,000 miles is mostly flat, indented by many bays, and protected to some extent by coral reefs, but safe harbours are rare. The surface is undulating, being broken by the Darling, Blackwood, and Victoria Ranges, which seldom exceed 2,000 feet in height. Sheep-farming, pearl-fishing, gold, tin, lead, and copper mining, and the felling of timber are as yet the most profitable industries. The first settlements were made at Perth, Fremantle, and Guildford in 1829, and convicts were sent out from 1848 to 1868, voluntary emigration progressing but slowly. Great strides have, however, been made in the last twenty years, and 826 miles of railway are now open. In 1890 the Crown Colony received a constitution, and became self-governing, like the other possessions of Great Britain in Australia. Perth, on Swan River, is the capital; Fremantle, Albany, Geraldton, York, and Bunbury are growing townships. Recent discoveries of gold give a strong impetus to colonisation.

West Indies, the name given by early geographers to the group of islands scattered between the continents of North and South America, the impression being that they formed part of Asia. The archipelago extends from 10° to 27° N. lat., and from 59° 30' to 85° W. long., and is roughly divided into the Bahamas, the Greater and Lesser Antilles (these last comprising the Leeward and Windward Islands), and the coast islands of Central and South America. The Bermudas, since 1834, have been excluded from the number. They are chiefly volcanic, and present a bold and rugged outline, rising to the height of 8,000 feet. The total area is about 95,000 square miles, the valleys producing sugar, coffee, cocoa, cotton, indigo, tobacco, spices, drugs, fruits, and every kind of tropical vegetation, whilst the mountains are covered with a great variety of valuable timber. There are great mineral resources, Cuba especially being rich in copper and gold. The climate, though tropical, is not excessively hot. Fevers, however, prevail on

the coasts, and hurricanes cause serious losses. Early in the 17th century England, France, and other European Powers began to form settlements, and during the subsequent wars up to 1815 the islands frequently changed hands.

Westminster, a parliamentary borough and city of Middlesex, comprising a large portion of the west end of London. Known in earlier times as Thorney Island, it grew up around the Saxon palace and the minster of St. Peter (now the Abbey) in the 7th century, and is described in Domesday as a village. The liberties extended from the Thames to Tyburn and from the Horseferry Road to the Fleet Ditch, and in 1541, being made the seat of a bishopric, it was raised to the rank of a city. Parliaments were held here in the 13th century, and the courts of justice followed the regal Court and ultimately became established within its precincts. The Abbey was founded on the old site by Edward the Confessor (1049-65), rebuilt by Henry III. (1245-72), and enlarged and beautified by various monarchs and by successive abbots. Westminster Hall, first built by William Rufus, but roofed and remodelled by Richard II., has been recased with modern stonework.

Westmoreland, a county having an area of 758 square miles between Durham and Cumberland N., Lancashire W. and S., Yorkshire E. and S., and Durham E. Most of the surface is broken by the Pennine and Cumbrian ranges (Helvellyn 3,118 feet, Fairfield 2,950 feet) and by bleak moorlands; but the valleys, especially in the S.W., are fertile, and contain rich pastures, whilst the forests yield valuable timber. The lakes of Grasmere, Windermere, Rydal Water, and Ulleswater are noted for natural beauty. The Kent, the Eden, and the Lune are the chief rivers. Besides Appleby, the capital, Kendal and Kirkby-Lonsdale are the only towns of importance.

Wexford, a county in the province of Leinster, Ireland, with an area of 896 square miles, washed east and south by the Atlantic and St. George's Channel and bounded inland by Wicklow, Carlow, Kilkenny, and Waterford. Mountainous in the north, where Mount Leinster attains a height of 2,600 feet, it is level and fertile towards the coast, several lagoons dotting the surface. The Barrow, Slaney, Derry, and Bann are the chief rivers. Wexford, the capital, stands on the right shore of the Slaney estuary, which forms a fine harbour, doing a considerable export and import trade. It returns one member to Parliament. Other towns are New Ross, Newtonbarry, Enniscorthy, and Gorey.

Whale, a book-name for any member of the order Cetacea (q.v.), of which there are two living groups or sub-orders, the differences between which are strongly marked. They are known as (1) Mysticoceti, or Balanoidea, from the baleen or whalebone with which the mouth is furnished, and (2) Odontoceti, Delphinoidea, or Toothed Whales. The whalebone grows in flattened horny plates along each side of the palate, and its function is that of a

strainer or sieve. The Whalebone Whales feed on minute crustacea and small molluscs. The mouth is filled with water, and when the jaws are closed and the tongue raised the water streams out through the whalebone, leaving behind the small marine animals. These are swept off the whalebone with the tongue and swallowed, and the mouth opened for another catch. The genus *Balæna* contains the Right Whales, so called from their yielding the greatest quantity of blubber and the best baleen. The skin of the throat is smooth, there is no dorsal fin, the short broad pectoral limb has five digits, the head is very large and the baleen long and narrow, black in colour, and highly elastic. The Greenland or Arctic Right Whale (*B. mysticetus*) is found in the seas on both sides of Greenland. The length of an adult male is from forty-five feet to fifty feet. The Southern Right Whale (*B. australis*) has the head smaller in proportion to the body and its whalebone is shorter. Its home is in the South Atlantic, and there are varieties or local races. The Humpback Whale (*Megaptera böops*), the single species of the genus, is about the same size as the Greenland Whale, and the female is larger than the male. The dorsal fin is small and far back, and the skin of the throat is wrinkled into folds. *Neobalæna marginata*, from Australian seas, is the smallest whalebone whale. *Rhachianectes glaucus*, the Gray Whale, is from the South Pacific. [RORQUAL.] The Toothed Whales have many more representatives than the Baleen Whales, the most important being the Sperm Whale (q.v.). Allied to the Bottlehead (q.v.), and with a pointed rostrum, are the whales of the genus *Mesoplodon*, chiefly from the southern hemisphere, and the single species of *Berardius*, from the seas round New Zealand. The former have a single tooth on each side in the lower jaw; the latter has two. Of the River Dolphins there are three genera, each with a single species. In all the jaws are produced into a snout, and bear above and below a great number of teeth set close together. *Platanista gangetica*, from Indian rivers, is about eight feet long; *Inia genfroyensis*, from the Upper Amazon and its tributaries, seven feet long; and *Pontoporia blainvillei*, from the mouth of the Rio de la Plata, about five feet long. [For the true Dolphins, see BELUGA, CAAING WHALE, DOLPHIN, GRAMPUS, NARWHAL, and PORPOISE.]

Wheat, the most widely-diffused and important of cereal grasses. It is an annual, producing "tillers," or secondary shoots, from its base. Its leaves have a small ligule, and its inflorescence is a compound spike with a sinuous rachis and compressed spikelets. Below each spikelet are two "chaff scales," or outer glumes, and each spikelet contains from two to eight flowers, the upper ones sterile. The flower has a "flowering glume," which may have an awn, when the wheat is termed "bearded;" a delicate two-ribbed "pale;" two minute, pointed, membranous "lodicules;" three stamens; and a downy ovary, with two feathery stigmas. The grain is oblong or ovoid, with a furrow down one side, its seed so completely filling

it that their coats are only separated in milling. The outer cells of the endosperm contain the nitrogenous gluten, the inner ones being filled with starch-grains. The embryo or "chit" lies obliquely across the lower end of the albumen. Häckel recognises three species: *Triticum monococcum*, wild in Mesopotamia and Greece, found at Troy and in Swiss lake-dwellings, and now cultivated in Spain; *T. sativum*, including three races, the spelt (*T. spelta*), *T. dicoccum*, and *T. tenax*; and Polish wheat, *T. polonicum*, rarely cultivated in England. Both spelt and *T. dicoccum* were grown in prehistoric times, and are still cultivated in Southern Europe. De Candolle infers wheat to have had its origin in Mesopotamia, and many of the best authorities refer all the many cultivated varieties to a single wild ancestral form. *T. tenax*, the true wheats, include *compactum*, the soft wheats; *turgidum*, the turgid wheats; and *durum*, the hard wheats. Hard wheats are chiefly grown in hot, dry countries; turgid wheats, such as the many-spiked Egyptian or "mummy" wheat, in plains; spelts in poor mountainous soils. Cold climates produce thin, flexible, hollow straw, long ears, and soft floury grain; moist climates, broad leaves; hot climates, more solid and rigid straw, shorter ears, and more horny grain; and dry climates, narrow leaves, and bearded and downy glumes. The finest wheats are found in fertile alluvial valleys and plains. The soft wheats contain relatively more starch; the hard ones more gluten, the latter making the better flour. Hard wheat is used in the manufacture of macaroni. Bearded wheat is mainly advantageous as being protected from birds. Wheat requires a minimum temperature of 41° Fahr. to germinate, 42° to grow, 55° to flower, and more to ripen grain; but it is a remarkably accommodating species as to the time during which it obtains its full supply of heat. It is grown from the Straits of Magellan to lat. 65° in Norway.

Wheatear (from Anglo-Saxon *hvit-ears* = white-rump). *Saxicola ananthe*, a well-known chat, visiting Britain in spring and leaving in autumn. Length about six inches; the plumage on the upper surface is silver-gray, with a patch of white on the rump; there is some black on the wings, and the white tail-feathers are tipped with black.

Wheat Midge, a small fly known as *Diplosis tritici* (Kir.), a member of the family *Cecidomyiidae* and the order Diptera. The fly lays its eggs in the flower of the wheat; the maggots hatched from the eggs devour the pollen grains, and thus prevent the fertilisation of the flowers and formation of the grain.

Wheatstone's Bridge, in electricity, is an arrangement of conductors by which an unknown resistance may be balanced against others of known value, the object being to measure the former in terms of the latter.

Wheel and Axle consist of two cylinders turning round a common axis; the larger cylinder is termed the wheel and the smaller one the axle. The force, P, is applied at the end of a rope which

is coiled round the wheel, while the weight, w , or other force to be overcome acts at the end of a rope coiled round the axle. Since the force acts through a distance equal to the circumference of the wheel, while the weight is raised through a height equal to the circumference of the axle, and since the work done by each is the same, it follows that the ratio between P and w is equal to that between the circumferences of axle and wheel, or $\frac{P}{w} = \frac{\text{radius of axle}}{\text{radius of wheel}}$. This form is chiefly used to illustrate the principles of mechanics; in practice the wheel is replaced by a crank or lever or toothed gearing, which makes the machine respectively a windlass (q.v.), a capstan (q.v.), or a "crab."

Wheel Animalculæ, the popular name for members of the class Rotifera (q.v.).

Whelk, the common name for the members of the genus *Buccinum*, a genus of univalve mollusca or Gastropoda (q.v.). They are common on the English shores, ranging down, as a rule, to a depth of about 600 ft. from the tide-line. It is used extensively as food and as bait. Its eggs are enclosed in small membranous sacs known as "nidamental capsules." These are aggregated into clusters, which are familiar objects on the seashore.

Whipping, a punishment inflicted for several of the smaller offences. By a statute of the present reign striking or firing at the Queen is punishable with whipping thrice or four times, and by a statute of the reign of George IV. an incorrigible rogue may be whipped. The punishment of whipping was inflicted formerly on persons of inferior condition guilty of petty larceny and other smaller offences; but in earlier times, by the usage of the Star Chamber, it was never inflicted on a gentleman. The Criminal Law Consolidation Acts, 1861, provide for the punishment of whipping to be inflicted upon males below sixteen years of age who have been convicted of various offences.

Whip-Poor-Will (*Caprimulgus vociferus*), an American goatsucker, about ten inches long, and very much like the European species in plumage. The popular name is derived from its cry. It is found in the eastern states of the Union; in the western states it is replaced by a smaller species (*C. nuttalli*), with a similar though feebler cry; and southward by the larger Chuck-Will's-Widow (*C. carolinensis*).

Whirligig Beetles, a family of Coleoptera known as the *Gyrinidæ*. They are aquatic beetles, and live skimming over the surface of pools, following a circular or irregular darting course. They are small, and are, as a rule, bluish-black in colour. The best-known English species is *Gyrinus natator* (Linn.).

Whirlpools are circular currents caused upon the surface of water when opposing currents meet or when the wind blows upon the water in a particular way. The eddies caused when two swift rivers join, or when a stream encounters an obstacle on its way, round which it has to flow, are examples of small whirlpools.

Whirlwind. [TORNADO.]

Whist, a well-known scientific game of cards, is of some antiquity, though its form has considerably changed. It was formerly known by the names of "ruff," "trump," "ruff and honours," etc., and in some forms the whole pack was not employed. In 1743 appeared Hoyle's treatise, which was for some time the great authority. The game then played was what is now known as "long whist," the game consisting of ten points. At the beginning of the 18th century the old game was found too long, and was cut in half and called "short whist," the other game being now well-nigh obsolete.

White Ants are members of the family *Termitidæ* and order Neuroptera. They live in colonies containing an enormous number of individuals, which are divided into distinct castes—viz. kings, queens, workers, and soldiers. The two first are sexually mature; the two last are larvæ of either sex, in which, however, the reproductive organs are either rudimentary or not developed. The king and queen Termites are larger than the other individuals and are wingless. The queen, when full of eggs, is sometimes 3 inches long, and weighs as much as 20,000 neuters. The eggs hatch into larvæ, which are like the adults and do not pass through a metamorphosis. Some develop into workers; others are provided with a pair of powerful mandibles, and act as soldiers for the defence of the colony. In the early part of the rainy season generations of winged males and females are developed; these are guided out of the colony by the workers, and take their "marriage flight." They soon lose their wings, which may be seen to strew the ground for acres around the colonies. The insects then pair, and each pair founds a fresh family. The Termites live in large hives or mounds known as "termitaria." These are often of remarkable forms, and as much as 15 feet in height; they are composed of earth worked into a compact mass and made extremely hard and tough. This is traversed by galleries, and contains the chambers in which the insects live. The White Ants are extremely destructive to wood, paper, textile goods, leather, etc. The Termites are mainly tropical in distribution, but some occur in the United States, and some have managed to establish themselves in southern France.

Whitebait, the name given to the fry of the herring, often mixed with that of the sprat, when taken for the table. These small fish were formerly considered to form a separate species, and by some naturalists a distinct genus of the Herring family. Closer investigation, however, has led to their identification, and in a mass of "whitebait" the fry of the sprat can be distinguished from that of the herring. The small fish, boiled in lard, are esteemed as a delicacy.

Whitefield, or WHITFIELD, GEORGE (1714–1770), one of the greatest of the founders of Methodism, was a native of Gloucester, and was educated in his native town, afterwards graduating at Oxford. At college he became known to the two Wesleys, and was there distinguished

by his asceticism. In 1736 he was ordained, and in the following year visited London. His natural eloquence, which was increased by his intense enthusiasm, very quickly secured him a great reputation as a preacher. At the suggestion of the Wesleys he went to Georgia towards the close of 1737, but did not remain there long. On his return he carried out various preaching tours, and the Methodists were joined into one large sect, ever increasing in numbers. A rift occurred with Wesley in 1741 on a doctrinal subject, and each took his own way. Whitefield visited Scotland and Wales, and also paid other visits to America.

White Lead. The common pigment known by this name consists chemically of a mixture of basic carbonates of lead. In composition it is variable, usually corresponding more or less with the formula $2\text{PbCO}_3 \cdot \text{Pb(OH)}_2$. It is largely prepared by subjecting lead sheets or thin bars to the fumes of acetic acid and decaying tan (Dutch process), or more expeditiously by passing a current of carbonic acid through a solution of lead acetate containing the hydrate or litharge suspended in it. As a pigment white lead has most of the qualities required, but lacks permanence, turning black if exposed to vapours containing sulphuretted hydrogen.

Whiting (*Gadus merlangus*), a well-known food-fish of the Cod family, common on the coasts of Northern Europe, and occurring plentifully on our own shores. The colour of the back is brownish-yellow, becoming paler on the sides, and silvery-white on the under parts. The usual size is from twelve to fifteen inches, but much larger specimens have been taken. Whiting are very voracious, and feed on smaller fish, worms, and molluscs. The flesh is extremely delicate, but soon loses its freshness, whence large quantities of this fish are dried and salted chiefly for export. [BIB, COD.]

Whitlow, a form of inflammation met with in the thumb, one of the fingers, or more rarely one of the toes; it may affect the tissues under a nail or those within or surrounding the sheath of a tendon, or those of the periosteum of one of the phalanges. In the treatment of whitlow, particularly if the deeper structures are involved, an early incision is made, with a view to allowing the escape of any matter which may form.

Whitman, WALT (1819-1892), "naturalistic" poet, was born in Long Island, U.S., and was by trade a compositor and (in the War of Secession) a hospital attendant. In 1855 a great sensation was caused by his *Leaves of Grass*. His *Drum-Taps* appeared in 1865, his *Two Rivulets* in 1873, and an English edition of his *Poems* in 1868.

Whittier, JOHN GREENLEAF (1807-1893), American poet, was of a Quaker family, and was born at Haverhill, Massachusetts, where at first he worked on his father's farm, giving a portion of his time to shoemaking. In 1836 he published an Indian legend in verse, and this was followed by many volumes of poetry, such as *Ballads* (1838), *Lays of My Home* (1843), *Voices of Freedom* (1849),

In War Time (1863), and *Among the Hills* (1868). Many of his lyrics have become exceedingly popular.

Whittington, SIR RICHARD (1350?-1425), Lord Mayor of London, was a native of Pauntley, in Gloucestershire, where his father owned property. On the latter's death in 1370 Whittington came to London, and prospered so well in business that he became thrice Lord Mayor, was knighted, and lent large sums to Kings Henry IV. and V. A very romantic and popular legend has grown up around his name, and *Dick Whittington and his Cat* has amused many generations of English children. The dates of Whittington's tenure of the office of Lord Mayor are 1397, 1406, and 1419.

Whooping Cough (PERTUSSIS), an infectious malady characterised by respiratory catarrh, with accompanying attacks of cough, which in most instances terminate in a peculiar crowing inspiration or "whoop." The disease is usually met with in children. It is more fatal in spring and autumn than at other times of the year, and it is highly contagious; it usually runs a prolonged course, and its period of incubation is said to be about a fortnight. Three stages of the disease are described, the catarrhal stage, the convulsive stage (in which the paroxysms of cough assume prominence), and the stage of decline. Uncomplicated whooping cough is rarely fatal, but vomiting, bronchitis, pulmonary collapse, pneumonia, and convulsions are apt to occur in association with the disease. Treatment consists in keeping the patient indoors, in administering light diet and tonic remedies, and counter-irritation is sometimes applied. When the spasms of cough are severe, antispasmodic remedies are usually given, and any complications require special treatment.

Wicklow, a county and its capital in the province of Leinster, Ireland, bounded to the E. by St. George's Channel, and inland by Dublin. Kildare, Carlow, and Wexford, with an area of 782 square miles. The coast is steep, and has only the poor harbours of Wicklow and Arklow. All the central portion is mountainous, the highest points reaching 3,000 feet. The soil in other parts is fairly fertile, and a good deal of copper, lead, and iron is exported. The Liffey, Slaney, Ovoca, and Vartry are the chief rivers. The town stands at the mouth of the Vartry, 28 miles S. of Dublin, and behind the Murragh peninsula.

Widgeon, Wigeon, any duck of the genus *Mareca*, which has numerous species widely distributed, distinguished by the bill being shorter than the head, small feet, long and pointed wings, and the wedge-shaped tail. The Common Widgeon (*M. penelope*) is a British winter visitor, and a few remain to breed in the north of Scotland.

Wigan, a parliamentary borough of Lancashire, 16 miles N.W. of Manchester, and in the centre of a great coal-field whence England derives a large proportion of her supply. There are extensive cotton factories, brass and iron works, etc. The town is ancient, the first charter dating from Henry III.,

and in the Civil War strongly supported the Royalist cause. It returns one member to Parliament.

Wight, ISLE OF (Latin *Vectis*), forms part of Hampshire, being separated from the mainland by the Solent and Spithead. It is triangular in shape, with a length of 23 miles by a breadth of 14 miles, and an area of 160 square miles. A range of hills runs through the centre, presenting a steep face to the S., fringed by the Undercliff, and sloping down to the sea with gentle undulations towards the N. St. Catherine's Hill is 830 feet high. The scenery is diversified and charming, the climate mild, and the soil fertile, especially to the E. Many sheep are pastured on the downs. The River Medina divides the island almost in halves. Newport, the capital, is in the centre; Cowes, in close proximity to the Queen's summer residence at Osborne, faces Portsmouth, and is a great yachting station. Near Newport are the ruins of Carisbrooke Castle, where Charles I. was imprisoned in 1647.

Wilberforce, SAMUEL (1805-1873), Bishop of Winchester, was the son of William Wilberforce, and was born at Clapham. In 1841 he was appointed Bampton Lecturer, and in 1845 Dean of Westminster. In the same year he was raised to the see of Oxford. A year previously he had issued his *History of the Episcopal Church in America*, a useful and interesting book. In 1869 he became Bishop of Winchester. In 1870 he published *Heroes of Hebrew History*, and in 1874 his *Essays Reprinted from the Quarterly Review*. He was killed by a fall from his horse near Dorking, 1873.

Wilberforce, WILLIAM (1759-1833), philanthropist and reformer, was born in Hull, and in very early boyhood became deeply religious, a state which lasted with slight intervals as long as he lived. He was educated in Yorkshire, to which his family belonged, and at the age of seventeen entered Cambridge University, where he graduated with distinction. On reaching his majority he became entitled to a large fortune, and, entering Parliament as an independent member, served the cause of reform very ably, gradually obtaining a reputation for eloquence. He had many years before formed opinions against the slave-trade, and after getting into Parliament he worked zealously for its abolition. In 1789 he introduced a Bill for its suppression, and though well supported did not succeed. In 1804 the Bill passed the Commons but was rejected by the Lords, and in 1807 it finally passed through both Houses. In 1825 he retired from Parliament owing to failing health, and towards his end suffered some heavy pecuniary reverses. He died in London just three days after the Government voted the sum of twenty millions for the entire abolition of slavery, and was buried in Westminster Abbey.

Wild Birds. Certain wild birds in the United Kingdom are protected during the breeding season by the "Wild Birds Protection Act, 1880." This Act was altered in regard to an exception for birds received from abroad, and by the insertion of larks in the schedule of protected birds by the "Wild Birds Protection Act, 1881."

Wild Duck, the Mallard (*Anas boschas*). [Duck.] The term may include the Teal, Garganey, Widgeon, Harlequin Duck, and its close ally the Garrot, or Golden-eye, the Sheldrake, Shoveller, etc., or, indeed, any duck, British or foreign, that is not domesticated. (Used also collectively.)

Wild-Fowl, a collective term equivalent to Wild Duck (q.v.); applied also to Water-Fowl valued for food or for the sport they afford. The decoy, now rapidly going out of use, consisted of numerous channels, growing narrower by degrees, extending from a piece of open water. Into these channels, covered with network of some kind, wild-fowl were induced to enter by tame decoy-birds, or by scattering food. Once in, they were driven towards the small end by trained dogs on the bank, and were then easily taken.

Wilkes, JOHN (1727-1797), a notorious politician of the last century, was born in Clerkenwell, where his father was a rich distiller, and obtained his education at Leyden University. At the age of twenty-two he married a heiress, from whom he was separated after a year or so with much discredit to his character. He retired to Buckinghamshire, and became its High Sheriff and in 1757 was returned to Parliament as M.P. for Aylesbury, making himself very conspicuous by his reckless attacks on all those from whom he in any respect disagreed. He started a paper called *The North Briton* in 1762, which was seized in the following year, and he himself thrown into the Tower for a violent diatribe against the king. As the arrest was unconstitutional, he was released and obtained damages. In 1764 he was expelled from the House of Commons, and was again tried for republishing *The North Briton*, and for circulating an obscene poem, the *Essay on Woman*. He fled to France, and was attainted. He was, however, popular with the people, and on his return in 1768 was elected M.P. for Middlesex, and after five expulsions and re-elections took his seat in 1774, when he also became Lord Mayor.

Will. A will is a written instrument by which the person making it (who is the testator) provides for the distribution or administration of his property after his death. It does not take effect until the testator's death, and is always revocable. A person having testamentary capacity may dispose by will of all real and personal estate to which he is or shall become entitled, and which, if not so disposed of, would devolve upon his heir, executor, or administrator. No particular form of words is required to make a valid will, so long as the testator's intention can be ascertained; otherwise its provisions will fail for uncertainty. A will must be signed at the foot or end by the testator, or by some one in his presence and by his direction, and the signature must be made or acknowledged by the testator in the presence of at least two witnesses, who must be present together at the same time, and must attest and subscribe the will in the presence of the testator. A devise or bequest to an attesting witness does not affect the validity of the will, but such devise or bequest is void. Every

will is construed with reference to the real and personal property comprised in it, to speak and take effect as if it had been executed immediately before the death of the testator, unless a contrary intention shall appear. See the "Wills Act, 1837;" it does not extend to Scotland. [EXECUTOR.]

Will, that faculty in man which controls some of his muscular movements, and to some extent his thoughts and even his feelings. The question how far man in his actions is independent of external circumstances is one that has occupied thinkers from the earliest dawn of philosophy.

William I., THE CONQUEROR (1027-87), son of Robert "the Devil," Duke of Normandy, and the daughter of a tanner, succeeded his father at the age of eight, and was almost at once threatened by the serious revolts of the nobility, who finally broke out in open rebellion, which was not ended till 1054, when William gained a notable victory at Mortemer. He later gave a serious check to France, and in 1060 obtained possession of Maine and Brittany. His illegitimacy did not prevent William from claiming the throne of England, basing his pretence on a slight relationship through his grandfather's sister. On hearing of the accession of Harold after the death of the Confessor, he immediately prepared to invade England and landed at Hastings on September 28, 1066. He defeated Harold, but did not reach the throne without a further struggle. In December, 1066, he was crowned King of England, but troubles soon arose, and William, who had returned to Normandy in a misleading moment of peace and order, came back and by unexampled severity managed to obtain paramount power, and the Norman conquest was complete. He died at Rouen.

William II. (1056-1100), surnamed "RUFUS" or the Red, was the second son of the Conqueror, and was born in Normandy. He came to England on his father's death, and was placed on the throne mostly through the influence of Lanfranc, in flagrant opposition to the rights of his elder brother Robert. The barons rose against the usurpation, but were repulsed. The king governed cautiously for some years, but after Lanfranc's death he acted in a most unconstitutional and arbitrary manner. He declined to fulfil his promise as to the restoration of Edward the Confessor's laws, and, instead of appointing bishops and other prelates when vacancies occurred, left the positions unoccupied, and estreated the revenues. With this ill-gotten money he partly built the Tower of London and London Bridge. He was killed in the New Forest.

William III. (1650-1702), was of Dutch origin and birth, and was the son of William II., Prince of Orange (whose title he assumed), and Mary, daughter of Charles I. He rose to high command in the United Provinces, becoming in 1672 Captain and Admiral-General, and the English and French, with whom he was then at war, offered to agree to his becoming despotic ruler of his states, but the proposal was declined. His Protestantism made him somewhat popular in England,

where James II.'s conduct was causing great dissatisfaction. William strongly opposed James after a time, and was finally invited to England, where he arrived in November, 1688, with a large army. James fled to France, and William insisted upon his full rights as king, which were granted after some hesitation, and he was crowned in 1689. Both Ireland and that portion of Scotland inhabited by the Highlanders still clung to James from religious motives. In 1690 James was defeated at the famous battle of the Boyne, and in the following year Limerick was surrendered, and Ireland was rendered comparatively peaceful. The Queen Mary, consort of William, died in 1695, and for several years fierce struggles occurred between the king and Louis XIV. of France, who had deliberately broken a treaty concerning Spain. Just as a great war between England and France was imminent, William was killed by a fall from his horse.

William IV. (1765-1837), third son of George III. and Queen Charlotte, was brought up as a naval officer, and served for some years under Rodney and Nelson, taking part in actions against the French, Spaniards, and Americans. His uncontrollable disposition, however, led to his leaving the service, though even after so doing he became Admiral of the Fleet. He married in 1818 the Princess Adelaide of Saxe-Meiningen, and succeeded to the Crown in 1830.

William I. of Prussia (1797-1888), first German Emperor, was descended from the Electors of Brandenburg, and was the second son of Frederick William, sixth King of Prussia. His whole life may be said to have been spent in the army, for he entered it at a very early age, and saw much service whilst still a boy. His elder brother having no issue, he became, in due course, heir-presumptive to the throne. In 1819 he married Princess Augusta of Weimar. On his father's death in 1840 he was appointed Governor of Pomerania, and whilst his brother was in England in 1842 acted as Regent of Germany. Owing to his opposition to certain reforms he was obliged to leave Berlin and take refuge in England, but he was recalled in two months. In 1857 his brother's weakness becoming more and more marked, he was again appointed regent, and devoted himself to the organisation of the army, which he was determined should be ready for all emergencies. In conjunction with Moltke and Roon, he brought it to a splendid state of efficiency. In January, 1861, he became King of Prussia, and in 1862 he gave Bismarck the appointment of Prime Minister, with *carte blanche* to carry out the system which had been adopted by the king and his generals constitutionally or otherwise. Bismarck accomplished this task by sheer force, and the Prussians were saddled with terrific expenditure in order that the army should be kept fully equipped. The result was justified by the "Seven Weeks' War" with Austria in 1866. [GERMANY.]

Williams, JOHN (1796-1839), a Christian missionary in the South Sea Islands, was born in London, and in 1816, after finishing an apprentice-

ship to an ironmonger, went to the South Seas in order to assist in missionary work. There he spent the greater part of a very noble life, zealously working amongst the natives, and spreading amongst them the truths of Christianity. His *Narratives of Missionary Enterprises in the South Sea Islands* (1837) had a tremendous circulation. On November 20th, 1839, he was murdered at Erromanga.

Willow, the general English name for the genus *Salix*, the type of the order Salicaceæ, which belongs to the Incompletæ. The genus is a large and very difficult one, comprising upwards of a hundred species of trees and shrubs, some of the latter being very minute. They belong mainly to northern temperate or arctic climates and to moist situations, the difficulty of discriminating the species being enhanced by the differences between male and female trees, as they are dioecious, and by hybridisation, which occurs freely in the wild state. They all agree in having deciduous, scattered, simple, stipulate leaves, and their flowers in catkins. These are often precocious, the pollen being carried both by wind and by insects attracted by perfume, honey, and the conspicuous yellow anthers, or ovaries silvery with hair. Each male flower consists of a single bract, a small nectary, and two, three, five, or (very rarely) more stamens. Each female flower has a similar bract, distinguished from that in poplars by not being notched, and a shortly-stalked ovary of two carpels, one-chambered, many-seeded, hairy externally, and furnished with a short terminal style and two stigmatic lobes. The seeds are exalbuminous and have each a *coma* or tuft of long silky hairs springing from the base. They grow quickly, forming a soft white wood, which does not splinter, and is used for wheelbarrows, the floors of waggons, cricket-bats, and other purposes. It also furnishes a good gunpowder-charcoal.

Willow-Herb, the popular name of the genus *Epilobium*, originating from the long lanceolate willow-like leaves of most of the species. They possess, it so happens, another resemblance to willows, with which they have no affinity, in their seeds, each of which is furnished with a tuft or *coma* of hairs. The genus belongs to the Onagracæ, and includes about fifty species, of which about a dozen are British. Their leaves, unlike those of willows, are exstipulate: they have four valvate calyx-segments; four, red or pink, contorted, petals; eight stamens; and an inferior ovary, elongating into a long pod-like valvularly dehiscent fruit.

Wilson, JOHN (1785–1854), novelist, poet, and critic, well-known as “Christopher North,” was a native of Paisley, where his father was a wealthy manufacturer. He studied at Glasgow and Oxford Universities, graduating at the latter in 1807. He settled near Windermere, where he became acquainted with Wordsworth, Coleridge, and other famous writers of the day, and in 1810 was married. In 1812 he published a poem, *The Isle of Palms*, which is in parts of great merit, and in 1816 his *City of the Plague* appeared. A year previously he had been admitted a member of the Scotch bar,

but did not seriously follow the legal profession. In 1817 *Blackwood's Magazine* was started, and Wilson is generally believed to have been its editor. The magazine was begun in a spirit of strong hostility to the Whigs, and, aided by Maguire, Lockhart, and Hogg, it soon became famous. Wilson's slashing style and rough, leonine personality can never be disassociated from it. In 1820 he became professor of moral philosophy at Edinburgh.

Wiltshire, or WILTS, a county in the S.W. of England, occupying an area of 1,343 square miles, between Gloucestershire N., Berks and Hants E., Dorset and Hants S., and Somerset W. The Vale of Pewsey divides it, the northern half flat and fertile, rising gradually to the Cotswold Hills, whilst the southern district is broken by a succession of downs and rich valleys, except in the neighbourhood of Salisbury Plain. The chief rivers are the Upper and Lower Avon, with their tributaries, and the Kennet. Dairy-farming and sheep-breeding are the chief industries, and the county is famous for cheese and bacon. There are carpet and woollen cloth factories at Bradford, Trowbridge, Westbury, and Wilton. Iron-stone is abundant, and foundries exist at Devizes; cutlery being made at Salisbury, the capital.

Winch is a practical application of the wheel and axle (q.v.). A barrel or drum is rotated by means of a cranked handle and intermediate toothed or other gearing arranged to give considerable mechanical advantage, and on this barrel a rope or chain may be wound. In a steam-winch a small engine is geared to the barrel. The term winch is also sometimes applied to a cranked handle.

Winchester, one of the oldest cities in England, was known as *Caer Gwent* (White City), in Keltic times, as *Venta Belgarum* under the Romans, and as the Saxon *Wintanceaster*, when it became *Cerdic's* capital. It stands on the River Itchin, in the county of Hants, 12 miles N.E. of Southampton. The first cathedral was completed in 648, when the see was instituted, but the existing structure dates from the close of the 11th century, many subsequent additions and repairs having been made. Among other interesting buildings are the Chapel of the Castle, containing the mythical “Round Table” of King Arthur; the house of the Knights Templars, Charles II.'s palace, and several venerable churches; but the great glory of Winchester is St. Mary's College, founded by William of Wykeham, in 1387, and now one of the chief public schools of England. Outside the town is the curious Hospital of St. Cross (1132).

Wind is merely moving air, and the velocity with which it moves is approximately proportional to the closeness of the isobars. [WEATHER.] Instruments for measuring the velocity of the wind are known as anemometers, and the same name is given to those which measure the pressure. The pressure of the wind is, however, a difficult thing to deal with, and no rigid connection has been found between it and the velocity. The latter varies from a few miles an hour in a faint breeze to 20 miles an hour in a steady one; 40 miles an hour will occur in

a gale, and as the speed rises the gale increases in destructiveness and merges into a hurricane. For use at sea Beaufort designed a scale of wind, based on the amount of canvas which a ship could carry, and the number of feathers in the arrows of synoptic charts (WEATHER) are drawn on this scale. A calm is indicated by 0, while winds of varying intensity are divided into 12 groups, the twelfth being such that the ship could carry no canvas whatever. Since difference of temperature at two places causes difference of pressure, winds are indirectly due to the former. Air from the warmer place, being relatively light, will ascend, while colder and denser air will flow in from the colder region to fill its place. This, carried on on a very large scale, is the cause of the *trade winds*. The whole of the tropics become heated more than the temperate zones, so the air there ascends, while a breeze from the north and south sets in towards the heated belt. If the earth were not rotating, there would be a wind from the north in this hemisphere, and one from the south in the southern world. But the rotation of the earth alters this direction; while a place in the equator is travelling round with a velocity of 1,020 miles an hour, it is only half this on the 60th parallel, and nothing at the poles. The wind, then, is coming from a place moving from west to east slowly to a place moving much faster. Each place that it reaches is travelling from west to east faster than itself; it therefore gets left behind, as it were, and seems to the inhabitants of the places to be blowing *east*. In the northern hemisphere it is, therefore, partially a north and partially an east wind, a north-east wind being the result. In the southern hemisphere the trade wind is south-east. The trade winds are specially noticeable in the Atlantic and Pacific Oceans, where they blow from about the 30th parallel to the equator, a difference of latitude of a few degrees occurring between the two oceans and the two hemispheres. The trade winds from the north and south meet in a belt about 4° wide in the tropics, and this is known as the Region of Calms, called by sailors the Doldrums.

Wind-change, DOVE'S LAW OF, postulates the doctrine that the system of atmospheric currents obeys the influence of the earth's rotation.

Windermere, or WINANDERMERE, a lake on the borders of Westmoreland and Lancashire, 10½ miles long (N. to S.), 1 mile broad, and 240 feet deep, being the largest fresh-water lake in England. It receives several small streams, and gives off the Leven, which flows into Morecambe Bay. On its E shore stands the town of Windermere, practically one with Ambleside, in a very picturesque situation. It has sprung up, since the railway was opened in 1847, on the site of the village of Braithwaite.

Windpipe. [TRACHEA.]

Windsor, NEW, a parliamentary and municipal borough in Berkshire, on the Thames, 22 miles W. of London. It includes Eton, with which it is connected by a bridge. Old Windsor, the site of the royal residence in Saxon times, is a village 2 miles to the E. St. George's Chapel and Wolsey's, or the Memorial Chapel are

beautiful examples of architecture and decorative art. Many improvements have been effected by Queen Victoria, who resides there for several months in every year. The Home Park contains Frogmore and the Mausoleum of the Prince Consort. The Great Park, with its fine avenue, the Long Walk, extends to Virginia Water. Windsor has little trade except that arising from the Castle and Eton College, but the markets are well attended. There are barracks for cavalry and infantry, a good town hall, and other buildings. One member is returned to Parliament.

Winnipeg, LAKE, in British North America, between 50° 30' and 54° N. lat., with a length of 305 and a breadth of 60 miles. It receives the waters of the two Saskatchewan, the Assiniboine, and the Red River, discharging into Hudson Bay by the Nelson. The shores are low and the water muddy.

Wintergreen, a popular name applied to a variety of plants, especially the ericaceous genus *Pyrola*, the primulaceous *Trientalis*, and the ericaceous *Gaultheria procumbens*, a native of North America, where its berries are known as *partridge*-, *chequer*-, *deer*-, *tea*-, or *box-berries*. The oil consists almost entirely of the methyl salt of salicylic acid, $C_6H_4(OH)CO_2CH_3$, and if heated with caustic potash it decomposes into methyl alcohol and the potassium salt of salicylic acid.

Wire is made by drawing a bar of metal through a tapering hole in a plate of steel, called a draw-plate, and may be reduced to almost any required size by being drawn through other holes of successively smaller diameter. Metals are greatly hardened by this process, so that frequent annealing is required. Ruby or agate bushes, pierced with holes of the required size, are used for making fine wires of gold, platinum, etc. Wire may be made of round, square, or other section by making the holes in the draw-plate of corresponding shape. The diameter of round wire is most conveniently measured in thousandths of an inch (mils.), or in millimetres, but for commercial purposes the Imperial Standard Wire-gauge is used, which ranges from No. 7, which is 0.5 in diameter, to No. 50, 0.001 in diameter. This has superseded the Birmingham gauge, which was not a reliable standard, as the diameter corresponding to any given number was not an invariable quantity.

Wire-Worms, the larvæ of certain beetles belonging to the family known as the *Elateridae*. Their popular name is derived from the fact that they are long, cylindrical, and extremely tough. They live in the ground and feed on the roots of plants, etc. They survive for several years, and do serious damage to crops. *Elater lineata* is a well-known English species.

Wisconsin, one of the United States of America, has an area of about 54,000 square miles, being bounded S. by Illinois, N. and E. by Lakes Superior and Michigan, and W. by the Mississippi. The river from which it takes its name flows through it to the W., and joins the Mississippi after a course of 270 miles. Other important rivers are the Black, Chippewa, Bois Brulé, St. Louis,

Milwaukee, Fox, and Menomonie. Lakes abound, Winnebago, Green, Geneva, Koshkonong, and St. Croix being the largest. The surface is undulating, and the soil fertile. Cereals, potatoes, maple sugar, hops, hemp, and flax form the staple products. There are valuable forests in the N., and extensive prairies in the S. Lead, iron, copper, zinc, and silver are among the mineral resources. Madison is the capital, and other centres of population are Milwaukee, Fond-du-Lac, Janesville, La Crosse, and Racine.

Wistaria, or, more correctly, *Kraunhia*, named after Caspar Wistar of Pennsylvania, is a genus of climbing leguminous shrubs with pinnate leaves and profuse pendulous racemes of lilac flowers, natives of North China, Japan, and North America. *W. chinensis* is the species commonly grown on walls in England.

Witchcraft, a particular form of magic (q.v.) with a very wide range in time and space. Tylor says that "witchcraft is part and parcel of savage life. There are rude races of Australia and South America whose intense belief in it has led them to declare that if men were never bewitched, and never killed by violence, they would not die at all." The idea of witchcraft that grew up in the Christian Church included an actual compact with the devil, and this lasted down to quite modern times, though it has perhaps faded out of the notion of such witchcraft as lingers—and a good deal does linger—amongst us. In the 10th century we have the first account by a Christian writer of the witches' sabbaths—meetings at which the devil was supposed to preside and receive the homage of the witches, with rites that cannot be named. Next came the notion that the witches rode through the air to these meetings on goats and other animals, and in 1310 a council held at Trèves denounced this as a delusion. Then the Inquisition took the matter up, and trials and executions for witchcraft became numerous, the only evidence being in most cases confessions wrung from the accused by torture or the outcome of diseased imagination. The strong measures taken against witches went on without check till the middle of the 16th century. In the middle of the century the work of Wierus, a German physician, did much to throw doubt on the reality of witchcraft, and towards its close Reginald Scot's *Discoverie of Witchcraft* had a similar effect. The *Demonologie* of King James (1597) supported the other side of the question. The Jesuit Spee (1631), though not directly attacking the belief, showed that many innocent persons had been put to death on that charge, and so produced a feeling in favour of greater caution in the proceedings. In England the witch-mania reached its height under the Protectorate. Scotland has an unhappy notoriety in this matter, as may be seen from Scott's *Letters on Demonology and Witchcraft*; and New England was as guilty as Europe in the matter. The last person tried for witchcraft was convicted in 1712, but the sentence was not carried out. In 1727 a woman was burnt in

Scotland on a charge of attending a witches' sabbath, riding thither on her own daughter, whom the devil had changed into a pony for that purpose. In 1726 prosecutions for witchcraft were abolished in Britain, but so-called witches were burnt on the Continent so late as 1793, and in 1860 one was burnt in Mexico.

Witenagemot, or COUNCIL OF WISE MEN, denoted among the Anglo-Saxons a meeting of the nobles, chiefs, large landholders, and chief ecclesiastics, and in the later days of Saxon rule it was the great council of the nation, which had for its counterpart under the Norman dynasty the council which became the germ of our House of Lords. The functions of the Witenagemot were to elect and depose rulers, to make laws and treaties, and to regulate ecclesiastical affairs and revenues in matters temporal.

Witness. [OATH.]

Woad (*Isatis tinctoria*), a biennial cruciferous plant, probably a native of South-Eastern Europe, was cultivated all over Europe for the blue dye obtained from it, until superseded by indigo (q.v.). Its general use is mentioned by Dioscorides and Pliny; and the name "Briton" is said to be derived from the Keltic *brit*, "painted," with reference to the use of this plant by the natives at the time of Cæsar's invasion.

Woking, a market-town of Surrey, on the Wey, 6 miles N. of Guildford. Owing to its dry soil and agreeable surroundings many villas have sprung up, and there are large nursery gardens. The Convict Prison for Women and Invalids, the County Lunatic Asylum, and the great London Necropolis add to the importance of the neighbourhood.

Wolf, a book-name for any member of the Thoïd or Lupine section of the Dog family [DOG], and popularly applied to the Common Wolf (*Canis lupus*), and its close allies, which some systematists rank as species, while others consider them as varieties. Wolves, with the exception of some varieties of the domestic dog, are the largest members of the family, and have a wide range in Europe, Asia, and North America, but are absent from South America and Africa. They do not take their prey by stealth and cunning, as do the foxes, but gather in large bands or packs and run it down in the open. The Common Wolf was formerly abundant in Britain; its extinction in England did not take place till the reign of Henry VII. (1485–1509). In Scotland the last wolf is said to have been killed in 1680, but some few survived till about the middle of the eighteenth century. The length of a full-grown European wolf is about 40 inches, exclusive of the tail, which may be put at about 18 inches, the height at the shoulder averages 33 inches. The usual colour of the fur is yellowish or fulvous grey, but individuals from the northern parts of the continent are usually lighter, and those from the southern parts darker in hue. The former are also larger than their fellows. Black races occur, and have been described as distinct species. The Wolf is readily tamed, and becomes

as faithful and affectionate to its master as a dog, but it is not to be trusted with strangers. Wolves breed freely with the domestic dog, and some of the North American Indians are said to cross their sleigh-dogs with the wolf to get increased speed and greater endurance. The Indian Wolf (*C. pal-lipes*), is smaller and less stoutly built than the European species, and is subject to great variation. The Thibetan Wolf (*C. laniger*), has a thick woolly pelages, yellowish-grey in colour; the black race of this form has been called *C. niger*. The American Wolf (*C. occidentalis*) is now considered identical with the European form. The Japanese Wolf (*C. hodophylax*), is doubtfully distinct. The Abyssinian Wolf (*C. simensis*), from the district of Simen or Semyen, is a large aberrant jackal, rather than a true Wolf. The Antarctic Wolf (*C. antarcticus*), of the Falkland Islands, is allied to the Prairie Wolf or Coyote (q.v.). The Maned Wolf (*C. jubatus*), with a wide range in South America, is a large solitary wild dog.

Wolfe, JAMES (1727-59). Major-General, was born, the son of Lieutenant-General Edward Wolfe, at Westerham Vicarage in Kent. He joined an infantry regiment in 1741, and showed so much courage and capacity in the battle of Dettingen that in 1744 he received a captain's commission. In 1745-46 he served against the Jacobites, taking part in the battles of Falkirk and Culloden. During the Seven Years' War he displayed conspicuous bravery at the battle of Lansfeldt (1747). His services in the disastrous Rochefort expedition (1757) attracted the attention of Pitt, who gave him the command of a brigade in the expedition to Cape Breton under Amherst (1758). In consequence of his extraordinary courage, energy, and skill at the siege of Louisburg, he was entrusted with the chief command in an attack on Quebec, in which action he was killed.

Wolf-Fish (*Anarrhichas lupus*), called also Cat-fish, Sea-cat, and Sea-wolf, a large voracious fish of the Blenny family, from the North Atlantic, valued in Iceland and Greenland as a food-fish. Its appearance is fierce and repulsive, the front of the mouth being armed with tusk-like teeth and the skin covered with slime. The average length is from 3 feet to 4 feet, and the general colour brown, barred with black. Two other species occur in the North Pacific.

Wolf-Hound, an Irish breed of dogs, formerly used to hunt the wolf, but now practically extinct. Applied also to the Borzoi, a Russian dog, somewhat like a very large greyhound, with long soft coat. These dogs are faithful and affectionate, and there is some doubt as to whether the name "wolf-hound" is appropriate.

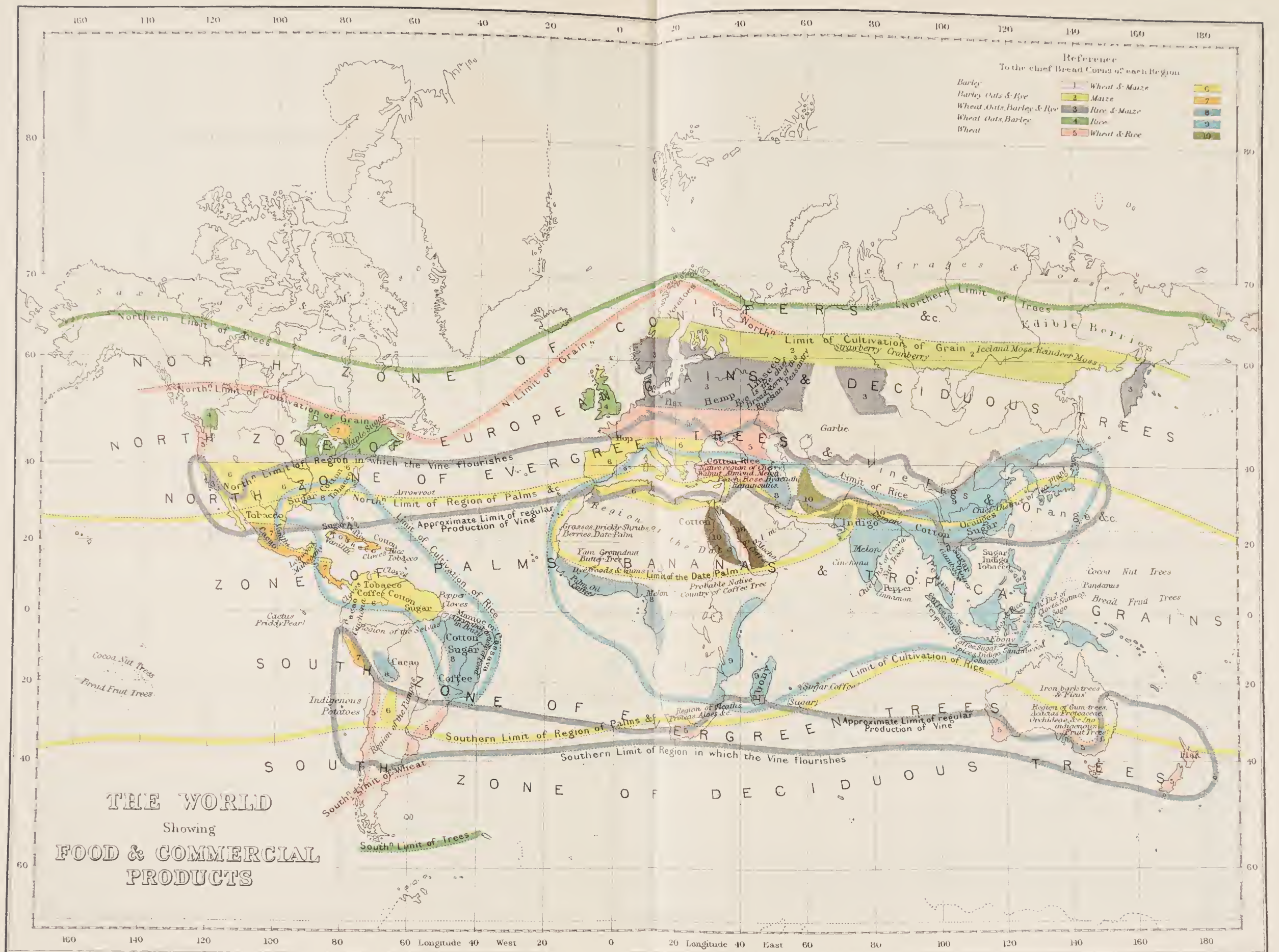
Wolseley. FIELD-MARSHAL GARNET JOSEPH WOLSELEY, VISCOUNT (b. 1833), was born in County Dublin. He served in the Second Burmese War (1853), in the Crimea (where he showed much personal bravery), during the whole of the Indian Mutiny, and in the Chinese War of 1860. In 1870 he suppressed the Red River rising in Canada in the course of three months. In 1873 he commanded

the expedition against Coffee Calcali, King of Ashantee, which was speedily brought to a successful issue. He was sent to reform the administration of Natal in 1874; went to Cyprus as High Commissioner in 1878; and, returning to South Africa in 1879 as Governor of Natal, the Transvaal, and the neighbouring territories, reduced Sikukuni to submission. After his campaign in Egypt against Arabi Pasha (1882), who was completely vanquished in the battle of Tel-el-Kebir, he received the title of baron, which was exchanged for that of viscount after the Soudan expedition in 1884-85. In 1890 he was appointed commander-in-chief of the forces in Ireland.

Wolsey, THOMAS (1471-1530), Cardinal, was born at Ipswich, the son of a wealthy grazier and wool-merchant, and educated at Magdalen College, Oxford, where he resided as tutor and master of Magdalen College School till the year 1500. He was then presented to the living of Lymington, in Somersetshire; and after acting as secretary and chaplain to Dene, Archbishop of Canterbury, became in 1503 chaplain to Sir John Nanfant, Treasurer of Calais, by whom he was brought to the notice of Henry VII. His progress in the royal service was rapid, and before the close of 1508 he had been named Dean of Lincoln. His social gifts recommended him to Henry VIII., and services of a more solid character rendered during the campaign against France in 1513 were rewarded with the see of Tournai. High offices were now showered upon him in quick succession. In the course of 1514 he was appointed Bishop of Lincoln and Archbishop of York, in 1515 he was made Chancellor and received a Cardinal's hat, and a year later Leo X. conferred upon him the office of Legatus-a-Latere. But it is for his foreign policy rather than his share in establishing Tudor absolutism that Wolsey deserves to be remembered by posterity. After the election of Charles V. to the Empire in 1519, a long struggle for supremacy in Europe began between that monarch and Francis I. of France. It was Wolsey's aim to maintain, as far as possible, an equilibrium in the power of the two states, and thus to make each dependent on English aid for any advantage it might hope to gain over the other.

Wolverhampton, a parliamentary and municipal borough of Staffordshire, standing on high ground $12\frac{1}{2}$ miles N.W. of Birmingham, and in the midst of the coal- and iron-fields. A convent was founded here in the 10th century, but the place only grew into importance recently. It is now the metropolis of the Black Country. Every form of industry connected with the metal trade is carried on here, and there are large factories for chemicals, colours, varnishes, papier-mâché, and japanned goods. Locks and keys are special products. It received a charter in 1848, having been enfranchised in 1832.

Wombat, any individual of the Marsupial genus *Phascolomys*, the type of a family *Phascolomyidae*. There are three species, all nocturnal, living on the ground or burrowing, and feeding entirely on vegetable substances. The largest



species, Mitchell's Wombat (*P. mitchelli*), some 3 feet in total length, from South Australia, may be brown, grey, or black, and has harsh coarse fur, as has also the Tasmanian Wombat (*P. ursinus*), but of a brownish-grey hue. The Hairy-nosed Wombat (*P. latifrons*), another Tasmanian species, has silky brownish-grey fur.

Wood, the general term for vegetable tissue in which the cell-walls are lignified or thickened by secondary deposits of *lignin*, which renders them harder and more elastic, and less permeable and absorbent, than before. Such tissue only occurs in large continuous masses in the stems of the higher plants, though present on a small scale in the endocarp of some fruits, such as the cocoa-nut and the stone-fruits. In stems wood is confined to the inner part of the fascicular tissue [XYLEM] and to the fundamental tissue. It consists of tracheæ (q.v.), tracheids, wood-fibres, and wood-parenchyma, the mode of thickening in the former being characteristic of certain groups of plants or of certain stages in the origination of the wood. [VEGETABLE HISTOLOGY.] In tree-ferns the xylem is largely made up of large scalariform tracheids, the densely lignified tissue being in isolated bands in the fundamental tissue. The exceptional use of some of the largest of these stems as timber is confined, therefore, to their employment whole, or, as it is technically termed, "in the round." In monocotyledons the wood occurs mainly as isolated sheaths of dense tissue round the fibro-vascular bundles; but these being crowded near the circumference of the stem, that whole region is often thickly beset with very dense strands, as in "porcupine-wood," the timber of the cocoa-nut palm, which is chiefly employed in veneers. The hollow-stemmed bamboos are used mainly in the round. Among gymnosperms and dicotyledonous angiosperms the wood is, after the first year, produced in a ring on the inner surface of the cambium layer, being partly fascicular and partly interfascicular, each ring usually marking a year's growth and the outermost ring being the newest. In the wood of gymnosperms tracheids take the place of true tracheæ, and the whole is generally formed rapidly and is known as "soft wood." Some kinds, however, such as cypress, yew, larch, and Scots pine, are very durable timber. These needle-leaved soft woods are mainly confined to the northern part of the cool temperate zone of the northern hemisphere, though represented by the Kauri pine, Huon pine, and others in the similar but detached regions of New Zealand and Tasmania in the southern hemisphere.

Wood, SIR CHARLES (1800–85), VISCOUNT HALIFAX, was from 1846–52 Chancellor of the Exchequer. In 1859 he became Secretary for India, where he did much good service. In 1866 he was made a peer.

Woodchat (*Lanius pomeranus*), a shrike having its home in Southern Europe and Africa, occasionally visiting Britain. Its length is about seven inches; the plumage on the upper surface is mostly black-and-white, and white below.

Woodcock, any bird of the genus *Scolopax*, type of a family Scolopacidae. These birds are allied to the snipes, but are larger and more stoutly built, with shorter legs. The Common Woodcock (*S. rusticula*) is a winter visitor, returning northwards in spring. Many remain to breed, and of late years the number has greatly increased. The length is nearly 15 inches; the plumage on the upper surface is rufous-brown, with small black markings; the under surface is wood-brown, marked with dark bars. The woodcock feeds on worms, insects, and small crustaceans, and is highly valued for the table.

Wood-Louse, the most familiar member of the order of Isopoda (q.v.). The wood-lice live under stones, leaves, etc., roll themselves into a ball for protection when frightened. They belong to the genus *Oniscus*.

Wood-Owl (*Strix stridula* = *Syrnium aluco*), a common British species, ranging northwards as far as Caithness and the Inner Hebrides. The total length is about 14 inches, and the plumage is reddish-brown with darker markings and light spots on the wings. [OWL.]

Woodpecker, any bird of the Picarian family *Picidae*, which contains some 250 species, widely distributed, but altogether absent from the Australian region. The bill is long and strong, and the extensile tongue is set at the tip with horny barbs. In the typical sub-family the tail-feathers are stiff, and are used by the birds as a support when clinging to timber in search of insects. Three species are British. The Green Woodpecker (*Geococcyx viridis*) is common in some parts of England. Its length is about a foot; the general plumage is green, with some crimson on the head and neck, and black on the cheeks. The Great Spotted Woodpecker (*Dendrocopus major*), some nine inches long, and the Lesser Spotted Woodpecker (*D. minor*), little more than five inches long, have black and white plumage. The nest is a hole in a tree, hewn out by the strong bill.

Wood-Pigeon. [PIGEON.]

Woods and Forests (public) are under the control of "the Commissioners of Woods, Forests, and Land Revenues and of Works and Public Buildings." There are two Boards appointed for the superintendence of the public properties indicated by their titles, including the royal parks in and near London and the other royal demesnes given up by the Crown on the settlement of the Civil List.

Wool, in its widest sense, denotes an animal covering partaking in a great measure of the nature of hair, the difference between them being in some respects hard to determine. The name is also applied by analogy to the fibres of vegetables, notably cotton.

Woolly Bear, the caterpillar of the Tiger Moth (*Arctia caja*). It has long woolly hair, and is of a red colour.

Woolsorter's Disease. [ANTHRAX.]

Woolwich, a parliamentary borough and river port of Kent, on the Thames, 8 miles below London.

Here a dockyard was established by Henry VIII., but the prosperity of the town dates from 1716, when the military arsenal was transferred from Moorfields. It is one of the largest establishments of the kind in the world, is four miles in circumference, and contains a gun-factory, laboratory, barracks for artillery and engineers, etc. The Military Academy, Herbert Hospital, and Military Museum are among its valuable institutions. The common provides a fine parade ground, and ranges for testing cannon are found on Plumstead Marshes. North Woolwich, on the other side of the river, is connected with it by steam-ferry.

Woolwich Beds, a sub-division of the Lower Eocene system, resting in the London basin conformably upon the Thanet Sands, but in the Hampshire basin directly upon the Chalk. They consist of clays and sands of various colours and shades, with pebble-beds, conglomerates, lignite, and shell-beds, varying in thickness in very short distances. They were formerly termed the *Plastic Clay*, the name *Argile plastique* being still employed for their equivalent in the Paris basin. The lowest bed of the series is generally a pebbly sand with shark's teeth and the shells of a large oyster, *Ostrea belloracina*, which occur in England at Reading in the west, Headley in the south, Bromley, Woolwich, etc., and in the Isle of Wight. At Reading and in Belgium plant-remains occur near this horizon, and at Woolwich the lower beds contain estuarine shells, such as *Melania* and *Cyrena*, and even freshwater forms, such as *Viviparus*. The upper beds are more marine, with fish-teeth and frequent shingle-beds, which last in Hertfordshire are consolidated into a hard puddingstone or conglomerate. These shingles are classed separately as "Oldhaven beds."

Worcester. 1. The capital of Worcestershire, is on the left bank of the Severn, 26 miles S.E. of Birmingham. It is one of the most ancient cities in the kingdom, having been the site of a Keltic settlement, a Roman camp, and a Saxon fortress. The noble Gothic cathedral, founded in 680, and rebuilt in the 13th century, is in the form of a double cross, and there are other churches of interest. The porcelain works, established in 1751, are famous for the artistic beauty of their wares. Glove-making is an industry of still earlier date. Chemicals and artificial manures, British wine and vinegar, hardware, lace, and sauces are also manufactured. There is a good market, and a large trade is carried on in local produce by rail and river, whilst salmon-fishing yields a profit in the immediate neighbourhood. Cromwell in 1651 gained here a decisive victory over the Royalists. The borough returns one member to Parliament.

2. A city of Massachusetts, U.S.A., 38 miles S.W. of Boston, is an important railway centre, and the seat of many industries and educational establishments. On the common around which it is built stands a monument to the soldiers who fell in the War of Independence.

Worcestershire, a county occupying an area of 738 square miles, between Shropshire and Staffordshire N., Gloucestershire S., Warwickshire E.,

and Herefordshire W. The surface is undulating, with high ground to N.E., and the Malvern Hills (1,400 feet) to S.W. Lying in the basin of the Severn, and drained by the Teme, Stour, and Avon, it is well-watered and fertile, wheat, hops, cider-apples, pears, and fruit of other kinds being the chief products. There are rich pastures in the river valleys. Coal, iron, and salt are abundant in the north. Dudley is the centre of the coal and iron trade, and Droitwich of the salt district. Carpets and rugs are made at Kidderminster, gloves and porcelain at Worcester, glass at Stourbridge, and fish-hooks and needles at Redditch.

Wordsworth, WILLIAM (1770-1850), poet, was born at Cockermouth in Cumberland. His father was agent to the Earl of Lonsdale. Before his fifteenth year had elapsed he had lost both his parents. He received his education at Hawkshead Grammar School, Lancashire, and St. John's College, Cambridge. After leaving the university he led a somewhat desultory life, unwilling to enter the Church, and not as yet fully conscious of his true vocation. He was drawn to France by his sympathy with the Revolution, unsullied as yet by the horrors which afterwards produced so powerful a reaction in his mind. He afterwards spent several years in Dorsetshire and Somersetshire with his sister Dorothy, a woman of ardent temperament and keen poetic insight, who from his earliest years supplied those "gentler charities," in which, as De Quincey says, his "stern and austere" genius was by nature somewhat lacking. During this period he saw much of Coleridge, and the two poets no doubt exercised a reciprocal influence. In 1798 they published a volume of *Lyrical Ballads*, containing, among other pieces, Coleridge's *Ancient Mariner* and Wordsworth's *Lines Composed above Tintern Abbey*. In the same year the brother and sister made an expedition to Germany, and some of the happiest of his shorter poems were written during a bitterly cold winter at Goslar. Soon after their return they took up their abode in a cottage at Grasmere. In 1802 Wordsworth married his old schoolmate and play-fellow Mary Hutchinson. Twelve years later the Wordsworth household removed to Rydal Mount, and there the poet spent the remainder of his life. The most ambitious, but not the greatest, of his efforts was the *Excursion* (1814), a long philosophical poem in blank verse. In 1843 he succeeded Southey as poet-laureate. For many years before his death he enjoyed in full measure the recognition and honour which had been denied him in his younger days. In common with all the great poets of his own and the next generation, Wordsworth was deeply affected by the great movement of thought which swept over Europe during the closing decades of the 18th century. On its political and social side this movement has become closely associated with all that was best in the French Revolution. In the imaginative sphere its first tendency was to lead man back from the artificial life of towns to the grandeur and simplicity of Nature; but it did much more for him than this—it opened up for him new possibilities

in his spiritual life, taught him to find a deeper meaning in every sight and sound of the external world; it may almost be said to have given him a new soul. The dazzling hopes thus inspired might well breed strange visions in over-impulsive minds, but Wordsworth's was one of those rare natures, richly endowed with all high gifts, in which the æsthetic, emotional, and religious elements are so happily blended that every fresh gleam of poetic insight is at the same time a revelation of ancient and eternal truth.

Work must always be expended when a force is overcome. Thus in lifting a stone the force overcome is the weight of the stone, and the work done is proportional to the weight and to the distance through which it is raised. If the stone be moved up a smooth inclined plane, it is not the actual space through which it moves which is of importance, but the *vertical* distance; in fact, the amount of work is estimated by taking account of the distance moved through only in the *direction* of the force. If the inclined plane be rough, as it always would be, a fresh force comes into play—that of friction—and, since friction acts *along* the plane, the work done against this force will be proportional to the actual distance travelled along the plane. Work may be done in overcoming many other kinds of force—thus, in order that a current of electricity may be produced when a wire is moved in a magnetic field, work must be expended in moving the wire, and work must be also spent in compressing a spring—the elastic force being overcome in this case—and work is done on a body in order to alter its velocity. In the latter case the work done is exactly equivalent to the alteration of the kinetic energy of the body, which is measured by the product of half the mass and the square of the increase in the velocity. When friction is overcome all the work is converted into heat, and Joule and others have shown the connection between the work expended and the quantity of heat evolved. [THERMODYNAMICS.]

Worms, a city of the Grand Duchy of Hesse-Darmstadt, 26 miles S.E. of Mainz, near the left bank of the Rhine. It dates from before the Roman period, and attained its greatest prosperity in the 13th century, when it was an Imperial city. The Diet of Worms in 1495 was summoned by Maximilian I., and before another, held in 1521, Luther appeared. The streets are narrow and gloomy, and the Romanesque Dom (8th to 12th century) has suffered much from time. The Liebfrauenkirche offers a fine example of 11th-century Gothic. There is a colossal monument to Luther (1868).

Wormwood, a general name for the various species of the Composite genus *Artemisia*, shrubby plants, the wood of which was formerly much employed as a vermifuge. They have divided and generally glaucous leaves and panicles of small flower-heads, generally rayless, with an imbricate involucre, naked receptacle, and no pappus to their fruits. There are 180 species, four of which are British. Many of them inhabit arid steppes, such as the *alkali bush* of the Western United States,

and the *Santonica* of the Kirghiz region, *A. pauciflora*. The unopened flower-heads of the latter are known as *wormseed*, and contain the crystalline *santonin*, $C_{15}H_{18}O_3$. *A. Moxa* is used in China and Japan in the preparation of the pellets employed in their remarkable system of wholesale cauterization known as “moxa.” Several Continental species are used in the manufacture of the liqueur known as *absinthe*.

Wounds are sometimes divided into two classes, those in which the skin remains intact (subcutaneous wounds), and open wounds; the latter, according to the nature of the injury by which they are occasioned, are classed as incised, punctured, lacerated, and contused wounds. A poisoned wound is a wound in which some poison has been inserted beneath the skin at the time of infliction of the injury (*e.g.* dissecting-room wounds, or wounds inflicted by the sting or bite of an animal).

Wrasse, any fish of the genus *Labrus*, type of a family (*Labridæ*) widely distributed in tropical and temperate seas. The genus *Labrus* has nine species, two of which are British—the Ballan Wrasse (*L. maculatus*), about eighteen inches long, and the Striped or Red Wrasse (*L. mixtus*), a few inches less. These fish generally frequent rocky shores, and feed on crustaceans and molluscs.

Wreck-Fish (*Polyprion cernium*), the Stone Bass, from European coasts. It owes its name to the fact that it is often found near floating wood, the small marine animals thereon affording a good food-supply.

Wren, any bird of the genus *Troglodytes*, type of the Passerine family *Troglodytidae*. The bill is of moderate length and pointed, with the nostrils at its base, and covered by a membrane; wings very short, concave, and rounded, and the tail generally short and erect. The plumage is long and soft. The family has nearly a hundred species. Of the type-genus there are fifteen, ranging over the Neotropical, Nearctic, and Palearctic regions to the Himalayas. Worms and insects constitute the chief food. The Common Wren (*T. parvulus*) is resident nearly all over the British Isles, and in autumn migrants arrive from the north. The total length is about $3\frac{1}{2}$ inches, and the plumage is reddish-brown marked transversely with bars of a darker hue. The under surface is white tinged with yellow.

Wren, SIR CHRISTOPHER (1631–1723), architect, was born at East Knoyle rectory in Wiltshire. He studied at Wadham College, Oxford, where he gained a reputation as a mathematical scholar, and in 1653 was elected to a fellowship at All Souls'. He was professor of astronomy at Gresham College, London, from 1657 to 1660, when he became Savilian professor of astronomy at Oxford. In the following year he was appointed assistant to Sir John Denham, surveyor-general of the royal works, whom he succeeded in 1668. Meanwhile, in 1663, he had been entrusted with the preparation of plans for the restoration of Old St. Paul's, but after the Great Fire of 1666 it became necessary to rebuild the entire edifice. This work occupied Wren from 1675 to 1710. The design of the new cathedral was taken

from that of St. Peter at Rome. In 1718 Wren was deprived of his office of surveyor-general for purely political reasons. He died at Hampton Court.

Wrist Drop. [PAINTER'S COLIC.]

Writ, a document issued in the Queen's name, and under seal of the Crown, or the Lord Chancellor or other officer of the Crown, commanding the person to whom it is addressed to do or to forbear from doing some act. Writs are of two kinds: (1) prerogative and (2) of right. The former are so-called because they are issued by virtue of the Crown's prerogative; the latter are of two kinds, original and judicial. The only instance of an original writ now existing is the writ of error used in criminal proceedings. A judicial writ is of several kinds: as (1) the writ originating actions and other proceedings, (2) interlocutory writs, (3) writs of execution, etc.

Writer's Cramp. [CRAMP.]

Writing was first of all inscribed upon tablets of clay, the oldest of these cuneiform inscriptions being Babylonian, Egyptian, and Assyrian. The Egyptians used papyrus also for their writings, as did the Greeks. Paper was invented by the Chinese. [ALPHABET.]

Writing Machine, or TYPE-WRITER, is a mechanical arrangement whereby the pressure of the finger on a series of keys is made to print characters on a sheet of paper. In most of the numerous patterns which have been invented the types are fixed to a series of levers, and by other levers the downward motion of the keys causes the type to strike the paper. A piece of ribbon soaked in an ink which is permanently damp is interposed between the type and the paper, and arrangements are made for advancing it as each letter is printed. The paper is held between rollers covered with rubber, and moves transversely a certain distance after each key has been depressed, and the action of replacing the carriage holding these rollers at the completion of a line causes them to rotate a little, thus advancing the paper ready for the next line. The various machines differ principally in details, and in the relative position of the parts.

Wryneck, any bird of the genus *Iynx*, of the Woodpecker family. The tongue is extensile, and has a horny tip. The Common Wryneck (*Iynx torquilla*) visits Britain and the north of Europe in its spring migration. Its length is about 7 inches, and the ash-coloured plumage is marked with dark spots. The popular name refers to the snake-like motions of the bird's head and neck, and from its hiss when disturbed it is locally known as the Snake-bird.

Württemberg, or WIRTEMBERG, a kingdom forming part of the German Empire for military purposes, but enjoying domestic autonomy under a hereditary king and a Diet of two houses. It occupies an irregular area of 7,530 square miles between Bavaria, N., N.E., and S., Baden, W. and N.W., and Lake Constance S. The ranges of the

Black Forest in the W. and of the Swabian Alps in the S. offer considerable elevations, and the latter mountains divide the basins of the Danube and Neckar, which, with their affluents, the Iller, Enz, Kocher, and Jaxt, and the Tauber, a tributary of the Main, drain the country. The valleys are very fertile, producing cereals, vines, fruits of all kinds, beetroot, hops, and hemp. Sheep, horses, and cattle are numerous. Iron, coal, and salt are sources of considerable wealth, and other metals are profitably worked. Mineral springs at Wildbad and elsewhere attract many invalids. Stuttgart is the capital, and other large towns are Tübingen, the seat of the university, Esslingen, Heilbronn, Ulm, Reutlingen, and Ludwigsburg. Formerly part of Swabia, the duchy was raised to a kingdom in 1806 by Napoleon, and that act was confirmed by the Congress of Vienna, when the king deserted the French at Leipsic.

Wycherley, WILLIAM (circa 1640-1715), a dramatist and courtier of the reign of Charles II., was born at Clive, near Shrewsbury. His best plays were the *The Country Wife* (1675) and *The Plain Dealer* (1677).

Wyclif, JOHN (1325-84), was for some time at Oxford, and in 1374 was made rector of Lutterworth. In 1377 he was summoned to appear before the Archbishop at London on a charge of heresy. The council, however, was broken up, but the Pope issued a series of bulls urging the imprisonment of Wyclif. On the appointment of a new Pope, Wyclif became more aggressive, and advocated the abolition of the abuses in the Church, and denied the priestly power of absolution. He began, too, his translation of the Bible. In 1380 he attacked the doctrine of transubstantiation. A convocation bade him cease to maintain his views in the University of Oxford, and all his followers were compelled to recant. In 1384 he was struck with paralysis.

Wye, THE, or GWY, a river which rises on Plinlimmon, in Montgomeryshire, and, flowing S.E. through Radnorshire, Brecknockshire, Herefordshire, and Monmouthshire, falls into the Severn after a course of 130 miles, about 2 miles S. of Chepstow, up to which point it is navigable. Rhayader, Builth, Hereford, Hay, Ross, and Monmouth are on its banks. It is noted for picturesque scenery and for salmon-fishing.

Wykeham, WILLIAM OF (1324-1404), Bishop of Winchester, was born of humble parentage at Wickham, in Hampshire, and educated at the Prior's School, Winchester. He became Edward III.'s Surveyor of Works in 1359, and superintended the rebuilding of Windsor Castle. In 1306 he succeeded Edyngdon as Bishop of Winchester. He was Privy Seal 1364-67, and Chancellor 1367-71, but, owing to the jealousy of the baronage, headed by John of Gaunt, who desired to seize the temporalities of the Church, he fell into disgrace towards the close of Edward's reign. He was restored to favour under Richard II., and in 1389-91 was a second time Chancellor. His chief care during his later years was the erection of New College,

Oxford (1380-86), and Winchester College (1387-93), and the rebuilding of the nave of Winchester cathedral (1394-1402).

Wyoming, formerly a territory, but since 1890 a state, of the U.S.A., occupies an area of 97,883 square miles, being bounded N. by Montana, S. by Colorado and Utah, E. by Dakota and Nebraska, and W. by Idaho, Montana, and Utah. Traversed from S.E. to N.W. by the Rocky Mountains, it has a very rugged surface, interspersed with lofty plateaux like the Laramie Plains, 9,000 feet above sea-level. The rivers, especially in the N.W., flow through deeply-cut channels known as cañons. In this district, too, is the Yellowstone (q.v.) National Park, with the headwaters of the Missouri, Yellowstone, Snake, Green, and other great rivers. The valleys afford excellent pasture, and the mineral resources include iron, coal, gold, copper, silver, lead, plumbago, and petroleum.

X.

X = ks, the twenty-fourth letter of the English alphabet, is derived from the Greek through Latin. In Italian the letter has the sound *ss*, *sc*, or *cc*, and sometimes *s* takes the place of Latin *x*. In German it represents the sounds *ks*, *hs*, or *qs*, and in French it has a variety of sounds. Spanish represents it (1) by *ks* derived from Latin, and (2) by a guttural aspirate sound derived from the Arabic, and generally written as *j*.

Xavier, FRANCISCO (1506-52), the "Apostle of the Indies," was the son of Juan de Jasso, a nobleman at the court of the king of Navarre, and Maria Xavier, at whose castle in the Basque territory he was born. After studying at the College of St. Barbara in Paris he became professor of philosophy at Beauvais, and there formed a friendship with Ignatius Loyola, whom he assisted in founding the Jesuit Order. In 1541 he was sent by John III. of Portugal to preach the Gospel in India, and laboured successfully for seven years at Goa, in Travancore, at Malacca, in the Spice Islands, and in Ceylon. Following out the suggestion of a Japanese exile whom he had met at Malacca, he proceeded in 1549 to Japan, where he established a mission which continued to thrive for more than a century. Returning from Japan in 1552, he determined to attempt the conversion of the Chinese, and had proceeded as far as the island of Sancian, opposite Macao, in his second journey to the East, when he fell a victim to a malignant fever.

Xenophon (circa 435-354 B.C.), one of the greatest prose-writers of ancient Greece, was born at Athens. In 401 B.C. he was induced by his friend Proxenus of Boeotia to join the expedition of the Persian prince Cyrus against his brother, Artaxerxes Memnon. After the battle of Cunaxa the Greek officers were murdered, and Xenophon received a military command. Eventually he found himself the leader of his ten thousand compatriots, who, left alone in the heart of a strange country, were endeavouring to make their way back to their native

land. It was almost wholly owing to Xenophon's energy, courage, and military skill that this wild scheme was successfully accomplished, the Greeks arriving at the end of five months at Trapezus (Trebizond) on the Euxine, whence they made their way to Chrysopolis, opposite Byzantium. Owing to his Spartan sympathies Xenophon was declared a public enemy by the Athenians in or about 399 B.C. Three years later he attached himself to Agesilaus, King of Sparta, and became his devoted follower, accompanying him in all his campaigns down to 387, when he settled under Lacedæmonian protection at Scillus in Elis. The period of Spartan supremacy was brought to a close by their defeat at Leuctra (371), and Xenophon was forced to flee from Elis.

Xerxes (d. 465 B.C.), King of Persia, succeeded his father Darius in 485 B.C. After quelling a rising in Egypt, he turned his attention to the conquest of Greece, projected by Darius, and collecting a motley host, in which all the various races subject to the Persian dominion were represented, set out on the expedition in the year 480. The little band of Spartans which, under the command of Leonidas (q.v.), endeavoured to guard the pass of Thermopylæ, was annihilated after an heroic defence, and Xerxes advanced unopposed to Athens. In the narrow strait which divides Attica from the island of Salamis (q.v.) the Persian fleet, manned by Phœnicians, was utterly defeated by that of the Greeks, and Xerxes hastily returned northwards. The conduct of the campaign was left in the hands of Mardonius, but the Greek victory at Plataea (479) completed the discomfiture of the Persians. Xerxes was assassinated.

Ximenes de Cisneros, FRANCISCO (1436-1517), Cardinal, was born at Torrelaguna, in Castile. In 1482 he entered the Franciscan order, but the fame of his sanctity and learning had spread throughout the land, and after ten years' retirement he was induced by Queen Isabella to become her confessor. In 1495 he accepted, much against his will, the archbishopric of Toledo, which was forced on him by the Pope. He acted as regent after the death of Philip in 1506, and in the following year received a cardinal's hat from Julius II. The death of Ferdinand in January, 1516, again placed him at the head of affairs, and, in spite of his great age and the opposition of the nobles, he maintained his authority unimpaired till the arrival of Charles V.

Xiphosura, a group of Arthropods (q.v.), the members of which have a shield-shaped carapace or shield covering the head and thorax (or cephalothorax); the body terminates behind in a long abdominal spine or telson. The abdominal region is not marked off into two distinct regions, as in many allied animals. On the anterior part of it, which must correspond to the mesosoma, there are six pairs of limbs. The first pair of these form an operculum which protects the reproductive organs. The remaining five pairs are flat plates with a series of folds on their hinder surfaces. These act as the respiratory organs. The first pair of the appendages round the mouth are clawed. The

order at the present day is represented only by the *Limulus*, or King Crab, species of which occur in the seas of Malaysia and on the east coasts of America and Asia. They are of considerable geological interest, especially in the Palæozoic period.

Xylem, a term formed from a Greek root with a German termination, is used in vegetable histology (q.v.) for wood (q.v.). Xylem generally originates on the inner side of a procambial strand or rudimentary stele (q.v.), with the differentiation of one or a few tracheids or tracheæ, constituting the *protoxylem*. These are either spirally or annularly thickened. Other tracheids with pits are then differentiated from the procambium, making, with the protoxylem, the *primary xylem*. This may often contain also wood-parenchyma and fibres. The subsequent activity of the cambium-ring in exogenous stems gives rise to the annual rings of *secondary xylem*, most of the elements of which are lignified, whilst no spiral or annular vessels are present in it.

Xylophaga. This is the name of both a genus of Mollusca and a section of Beetles. In the former it is used for a member of the class Lamelli-branchiata (q.v.), which bores into wood floating in or submerged beneath the sea. It is closely allied to the genus *Pholas*, which bores into soft limestones and hard clays. The section of Beetles for which it is employed includes the Boring Beetles or Bark Beetles, which are very destructive to trees; thus *Scolytus destructor* (Oliv.) lives in the elm, *Phloeotribus oleæ* (Fabr.) in the olive.

Y.

Y, the twenty-fifth letter of the English alphabet, is sometimes a vowel, sometimes a consonant. It comes from the Greek, in which language it is equivalent to *ü*. In Latin it is used in words derived from Greek, and probably had the same sound. This was also its sound in Anglo-Saxon. Thus *lyyte*, afterwards *luit*, became the *lute* of Norman French; and *hüs*, pronounced *hoos*, was the Anglo-Saxon form of "house" (*haus*). It also represents the Saxon *g*. Thus *gard* becomes *yard*; *geol*, *yule*.

Yak (*Bos grunniens*), a Tibetan ox, domesticated by the natives as a beast of burden. The wild race, generally brownish-black, is found near the snow-line, coming down in winter to feed on the grass in the wooded valleys. The domesticated race has white mixed with the darker colour. The size is somewhat less than that of the ox, and a long fringe of hair covers the shoulders, flanks, thighs, and tail.

Yam, the tuber of various species of the monocotyledonous genus *Dioscorea*, the type of the order Dioscoreaceæ. They sometimes reach a weight of 30, 40, or even 100 lbs., and closely resemble potatoes in composition and flavour, though richer in nitrogenous matter. *D. sativa* and *D. alata* are natives of India; and *D. Batatas*, the Chinese yam,

yields large crops in France and Algeria and is hardy in England, but is not appreciated, partly owing to the depth to which its roots penetrate.

Yang-tse-Kiang (not "Son of the Ocean," but "River of the Yang-tse" district) is formed by the junction in latitude 26° 30' N. and longitude 102° E. of two rivers which have their rise in Eastern Tibet. Thence it flows with a tortuous course of 3,000 miles into the Eastern Sea at Haimun, a little N. of Shanghai, which is situated in its vast delta. The estuary is 30 miles across, and the tide extends 520 miles, as far as the Po-Yang Lake. The highest treaty-port on the river is Chung-King (opened 1890), nearly 2,000 miles from the sea, and ships of small size can ascend half that distance. Hankow, 700 miles up, is approachable by vessels of 2,000 tons. Nanking stands at the head of the estuary. The river is in flood from May to September, and falls to its lowest in February. It carries down vast quantities of mud, which forms shifting banks and islands, rendering navigation difficult.

Yapock. [OPOSSUM.]

Yard, an English measure of length containing 3 feet or 36 inches. The standard yard, which is carefully preserved together with its authorised copies, is a bar of metal 1 inch square, consisting of a composition of 16 ozs. copper, 2½ ozs. tin, and 1 oz. zinc. In this bar are set two gold pins with dots marked upon them, and the distance between these dots at a temperature of 62° F. constitutes the regulation yard.

Yarmouth, GREAT, a port and parliamentary and municipal borough in Norfolk, on the Yare, including for purposes of representation Little Yarmouth and Gorleston in Suffolk. Unknown until after the Conquest, it received a charter from King John, and was fortified by Henry III. It is the chief seat of the herring fishery, but many other kinds of fish are sent to the London markets. The harbour and quays at the mouth of the Yare accommodate vessels of 900 tons. A large general trade is done.

Yarrow. [MILFOIL.]

Year is the time taken by the earth to revolve round the sun, and hence contains a complete cycle of the seasons. In early times it was reckoned as twelve lunar months, but this gave 354 days as the year, and the annual error of 11 days soon became so apparent that they were added on to the lunar months at various times in order to keep the year and the seasons in agreement. The Greeks added on a whole month every few years, and the Romans constantly changed their method of supplying the necessary days. Julius Cæsar, however, had the wisdom to see that the year should be reckoned by reference to the sun and not to the moon, and the *Julian* year of 365 days 6 hours was henceforth adopted by the Romans and all people under their rule. In the 16th century the year was found to be 365 days 5 hours 49 minutes, and this, known as the Gregorian year, now replaced that of Cæsar. For ordinary purposes, however, the year

is considered as possessing 365 days, and the extra hours, etc., are allowed for by means of an extra day introduced every four years. [LEAP YEAR.]

Yeast. A large number of vegetable fungi are classified as yeasts, all of them small and microscopic organisms. The best known is that which is distinguished as *Saccharomyces cerevisia*. It forms small rounded or elliptic cells which multiply in saccharine and other solutions by a process of budding, a small cell forming on the side of the parent, growing, and finally becoming detached. Under the influence of the yeast saccharine liquids undergo fermentation (q.v.), by which they decompose with the formation of alcohol and carbonic acid, together with smaller quantities of other products. This fermentation is that on which the preparation of almost all our fermented and spirituous liquors depends, as also the use of yeast in bread making. During the fermentation the yeast cells multiply rapidly and rise to the top of the vat or containing vessel as a scum, which is skimmed off and known as *yeast* or *barm*. This is again used to induce fermentation in fresh liquors. The yeast cells multiply most rapidly, and hence induce fermentation most speedily, if the temperature is about 25° C. (or 77° F.), and at about 40° C. almost entirely lose this power, being killed by high temperatures. [FERMENTATION.]

Yeast-Plant, *Torula* or *Saccharomyces cerevisia*. [YEAST.]

Yellow. [PIGMENTS.]

Yellow Fever, an infectious fever which prevails in some parts of the tropics, particularly in the West Indian Islands. The latent period is usually about 6 to 10 days; there is then a sudden rise of temperature with febrile symptoms, epigastric tenderness, and vomiting; after a day or two the last-named symptoms become more marked, jaundice being present, and the vomit often begins to contain blood (black vomit). Typhoid symptoms may then supervene, and in severe cases delirium, coma, and convulsions occur. The mortality in this disease is very high, and death usually results after the lapse of three or four days.

Yellowhammer (*Emberiza citrinella*), a well-known British Bunting, generally distributed in temperate Europe. The male is a little more than six inches long, with lemon-yellow plumage marked with chestnut and black; the colours of his mate are less brilliant. In summer these birds feed chiefly on insects; in autumn on wild fruits and berries, and in winter on grain.

Yellowstone Region, the region of the Yellowstone river which rises in the Rocky Mountains and flows into the Yellowstone Lake, and finally into the Missouri. The great National Park covers an area of more than 5,000 square miles, and is remarkable for its scenery as well as its hot springs and geysers.

Yeomen of the Guard, members of the bodyguard of the Sovereign. [BEEFEATER.]

Yew (*Taxus baccata*), a gymnospermous tree of an isolated character, forming the type of the

order Taxaceæ. It is a native of most temperate parts of the northern hemisphere, including Britain, where many aged specimens linger in churchyards. Its wood is a deep-brown, elastic, durable, fine-grained, and hard, the latter characters being the result of its extreme slowness of growth, which is such that some of the big trees above-mentioned are probably over two thousand years old.

Yezo, Yesso, or Jesso, also called MATSMAI, the most northerly of the islands of Japan, separated from Nippon by the Strait of Sangar, and from Saghalien by that of La Perouse. It has an area of about 62,500 square miles, being traversed from N. to S. by rugged mountains, mostly volcanic, but having fertile plains in the N.

Yokohama, the chief place of foreign trade in Japan, is situated on the Bay of Yedo, in the Island of Nippon, having Kanagawa as its port. Established under the Elgin Treaty of 1858, it is a well-built and prosperous town, and has grown to large size, though the Japanese Government looks on it with disfavour. The exports considerably exceed the imports, and consist principally of tea, silk, cotton, flax, tobacco, and native produce.

York (Latin *Eboracum*), the capital of Yorkshire, stands on the confluence of the Foss and the Ouse, 22 miles N.E. of Leeds. Originally the chief town of the Keltic Brigantes, it became the centre of Roman power in the North, and was the residence of Hadrian, Severus, Constantine, and other emperors. Under the Saxons it served as the capital first of Northumbria and then of Deira. The walls, originally Roman, but restored by Edward I., still exist. The noble minster was founded on the site of a previous Saxon cathedral in 1171 and was finished in 1472. Next in interest comes the mitred abbey of St. Mary, whilst All Saints, St. Dennis, and St. Margaret's are buildings of great antiquity. Of the old castle nothing is left but the keep—Clifford's Tower. The Guildhall dates from the 15th century. York possesses cavalry barracks, and is the headquarters of the Northern District. It is an important railway centre and the markets are well supplied.

Yorkshire, the largest of the English counties, has an area of about 6,000 square miles, being bounded E. by the German Ocean, W. by Cheshire, Lancashire, and Westmoreland, N. by Durham, and S. by the Humber and the counties of Lincoln, Notts, and Derby. It is divided into the East, West, and North Ridings (Riding = Trithing or third), each of which has peculiar characteristics. The East Riding (1,200 square miles), bounded N. by the Derwent, W. by the Ouse, and S. by the Humber, is mainly agricultural, growing wheat, barley, turnips, beans, and hay. There are iron-works at Beverley and Hull, and the latter is the chief centre of shipping trade with the Baltic. The West Riding (2,650 square miles) is the greatest manufacturing district in the world, containing between the Aire and the Don a great coalfield, about which cluster the industrial towns of Leeds, Bradford, Halifax, Dewsbury, Huddersfield, and Sheffield. Agriculture prospers also to the N.

and E., and in the N.W. are wide pastures and great dairy farms. The North Riding (2,100 square miles) is for the most part a pastoral country, being cut off from the East Riding by the Derwent and Rye, from the West Riding by the Ouse and Ure, and from Durham by the Tees. Iron is worked extensively at Middlesborough, which is a thriving seaport. Lead, limestone, alum, and jet are sources of considerable profit.

Yorubas, a large Negro people of West Africa, occupying nearly the whole of the region on the Slave Coast between Badagry and the Benin river west and east, and extending inland to about 8° N. lat.; chief divisions: Egbas (capital, Abeokuta), Ketu towards the Dahomey frontier, Jebus about Lagos, Ibadans east of the Egbas, Ondos, Ileshas, and Ilorins towards the eastern frontier, and the Yorubas proper in the extreme north, whose empire (capital, Oyo) was overthrown early in the present century by the Mohammedan Fulahs. Since then the Yorubas have been broken into a number of petty states either warring with the Dahomans or at strife amongst themselves till 1890-92, when the whole nation accepted the British protectorate. The Yorubas are an extremely intelligent agricultural and trading people.

Yucatan, a peninsula jutting into the Gulf of Mexico, Central America. Campeachy and Sisal are the two chief ports, and among the inland towns are Merida and Valladolid.

Yucca, a genus of Liliaceæ, occurring in the Southern United States, Mexico, and Central America. They are commonly arborescent, having a pericycle in which new fibro-vascular bundles originate in old stems. Their leaves are in a crown, rigid, linear-lanceolate, and acute, from which they have acquired the popular name of *Adam's Needle*.

Yukaghirs. [JUKAGIRS.]

Z.

Z, the last letter of the English alphabet, was the sixth letter in the Greek alphabet, where it is thought to have had the force of *ts* or *ds*. In Italian it still has this force, and is sometimes doubled, and represents the Latin *di* or *ti*. Z was introduced into Latin in the time of Cicero, and was apparently confined to words derived from Greek. In German it sounds as *ts*, in Spanish as *th*.

Zambesi, a river of Southern Africa which rises about lat. 11° S., long. 23° E., and flowing S. through a flat plateau till it attains a breadth of a mile, suddenly plunges in a cataract known as the Victoria Falls to a level some 400 feet lower.

Zamouse (*Bos brachyceros*), a buffalo from Western Africa, possibly only a variety of the Cape buffalo.

Zanzibar, or ZANGUEBAR, an island lying off the east coast of Africa, making up, with the

neighbouring island of Pemba, an area of 985 square miles. The territory on the mainland formerly extended from Tanghi Bay S. to Warsheik N. (1,100 miles), but the S. portion as far as Wanga was ceded to Germany in 1890. In that year the then Sultan Seyyid Ali accepted a British protectorate, and the revenue, troops, and other administrations are in British hands.

Zebra (*Equus zebra*), a striped wild ass from the mountain regions of Cape Colony. It stands about four feet at the shoulder; the ground-colour is white marked with black stripes, except on the under-surface and the inside of the thighs; the legs and base of the tail are barred with black. The Dauw, or Burchell's Zebra (*E. burchelli*) is larger and more stoutly built, the ground-colour is yellowish-brown, and the limbs are nearly white. Grevy's Zebra (*E. grevyi*) is the name given to a form from the Galla country. Some authorities consider it a variety of the True Zebra. [QUAGGA.]

Zebu, a general name for the humped cattle of India (*Bos indicus*). Of this species there are several breeds. In all the distinguishing feature is the hump on the shoulders, which in the larger forms reaches a weight of 50 lbs., and is esteemed a delicacy.

Zend. [IRANIC LANGUAGES.]

Zenith of a place is the point immediately overhead. It is thus the visible pole of the horizon, *i.e.* if we imagine a line drawn from the centre of the earth at right angles to the plane of the horizon, it will cut the sky in the point which is the zenith of the place under consideration. [NADIR.]

Zenobia, SEPTIMIA, Queen of Palmyra in the 3rd century A.D., is supposed to have belonged to a family of Arabic origin. In 272 the Emperor Aurelian led an army against her, and after several victories captured Palmyra. She was carried captive to Rome, and led in triumph through the streets, but eventually she was allowed to reside on a large estate near Tivoli.

Zeolites, a group of hydrous silicates of aluminium with some of the alkali metals, named from the Greek *zeo*, "I boil," because most of them give off their water of crystallisation when heated before the blowpipe with a frothing, or intumescence.

Zero, or 0, was the last symbol introduced into Notation (q.v.); the word is also used in connection with many instruments, the points from which measurements are made being often termed the Zero point, and the corresponding position of the instrument the Zero position.

Zeuglodon, the earliest genus that can be with certainty assigned to the Cetacea (q.v.). It occurs in the Eocene, especially in Alabama, Louisiana, Mississippi and Arkansas, but has been found in the Barton Clay of Hampshire. The name means "yoked teeth" from the double fang, the genus having originally been thought reptilian, and named *Basilosaurus*. The molar teeth have compressed crowns with serrated edges.

Zinc ($\text{Zn} = 65$). The preparation of zinc on a manufacturing scale was started at Bristol in 1743, and for many years little competition existed. The chief ores of zinc are the sulphide and the carbonate, known respectively as *blende* (q.v.) and *calamine*. The former occurs largely in Cornwall, Derbyshire, the Isle of Man, Cumberland, and North Wales, the latter chiefly in Spain and the United States. For the preparation of the metal from either of these sources, the ore is first roasted in furnaces or kilns, by which means it is converted into oxide with the loss of sulphur dioxide or of carbonic acid. This oxide is then well mixed with coal-dust and heated in clay retorts, and the reduced metal distilled over into attached clay receivers. The metal is usually remelted, skimmed, and cast in ingots; it is never pure, containing usually, quantities of lead, iron, tin, and arsenic associated with it. Zinc is a bluish-white metal which melts at about 430°C . and distils a little over $1,000^{\circ}$. It may be rolled or beaten into leaves, but impurities impair this power. It may, by slowly cooling the molten metal, be obtained crystalline, and a bar of zinc emits when bent a slight crackling sound. It has a specific gravity of about 7, and though if strongly heated it burns with the formation of a green flame and thick white fumes, yet at ordinary temperatures it is unalterable in moist air. Pure zinc is hardly attacked by acids, but the commercial metal is readily dissolved with the evolution of hydrogen and the formation of zinc salts. It forms one oxide, ZnO , which occurs native as red zinc-ore and, combined with other oxides, as *franklinite*. The *chloride*, ZnCl_2 , is obtained as the hydrate, $\text{ZnCl}_2\cdot\text{OH}_2$, by the evaporation of the solution formed by dissolving zinc in hydrochloric acid.

Zirknitz, LAKE, in Carniola, is 1860 feet above the sea-level. Owing to the tunnels in the limestone mountains its depth depends much on the rainfall. It is sometimes five miles long and sometimes dried up.

Ziska, or Zizka, JOHN (c. 1360–1424), the hero of the Hussite War, was born of a noble family at Trocznov, in Bohemia. He strove in vain to induce Wenceslaus to give active support to the Hussites, and was thus driven into open rebellion. After the outbreak of 1419 he was chosen commander-in-chief, and organised an army which was victorious over the Emperor Sigismund at Mount Wittkow (July, 1420). In the following year the citadel of Prague fell into his hands, and, although a wound received soon afterwards rendered him totally blind, he gained a series of victories over the Imperial forces, which at length induced Sigismund to promise the Hussites the free exercise of their religion. Whilst the negotiations were proceeding Ziska was attacked by the plague and died before the castle of Przbislav, near Czaslau.

Zither, a stringed instrument with a large resonance-box and a circular sound-hole in the middle. It is much played in Switzerland and Austria.

Zoæa, a stage passed through during the development of many species of the higher Crustacea; it has a massive head, with large paired eyes, a

median spine, and some pairs of appendages; behind this is a jointed abdomen without any appendages. It is so different from the adult that it was regarded as a distinct animal.

Zoantharia, a sub-class of the Actinozoa or Anthozoa (q.v.), including those in which the tentacles are simple, arranged in one or more circles; the number of the mesenteries and tentacles is generally either six or a multiple of six, and never of eight or some multiple of eight as in the Alcyonaria. It includes three groups—the *Actinaria* or Sea-Anemones, the Antipatharia or Black Corals, and the Madreporaria or true Corals. They are all marine.

Zodiac is a belt of the heavens extending about 8° on either side of the ecliptic. This gives it a width of 16° , and it was so chosen by the ancients since it included the paths of the planets then known—Mercury, Venus, Mars, Jupiter, and Saturn. But the discoveries of this century have shown that the planets are by no means confined to this zone, many of the asteroids travelling far beyond its limits. The zone was so named on account of certain resemblances to animals, which early astronomers imagined to be possessed by the constellations within it. The ecliptic and equator bisect each other in a line, and the points in which this line cuts the sphere of the heavens are called the equinoctial points. [EQUINOX.] That point which marks the passage of the sun from south to north across the equator is called the vernal equinox, and has always been considered a convenient starting-point for many astronomical measurements. When the zodiac was first used, this point was known as the first point of Aries, the first six signs being then to the north and the last six signs to the south of the ecliptic. But, owing to the movement of the earth's axis [EQUINOX], the vernal equinox moves backward on the ecliptic about 50 seconds in a year, so that now the constellation of Aries seems to have moved about 30 degrees *forward*. For convenience, however, the vernal equinox is still called the first point of Aries, and 30° farther on will be the commencement of Taurus, while the autumnal equinox will occur at the first point of Libra. As time goes on these divisions will get farther and farther away from the constellations of the same name, but in about 25,800 years the whole circuit will be accomplished, so that sign and constellation will again be united.

Zoetrope is an instrument or toy whose action depends upon the persistence of vision. A number of pictures, representing the different positions successively assumed by a moving object are rapidly presented to the eye. But the eye has not ceased to *see* one picture (although the picture has passed away) before the next is presented to it, and so, instead of viewing it as a new picture, it merely seems as though the object in the first has changed its position to that shown in the next. As the rest of the series comes into view, it seems to the eye as though the object were actually *moving* into the various positions indicated on the picture.

Zola, ÉMILE (b. 1840), was born at Paris. In 1871 appeared the first volume of the series of novels known as *Les Rougon-Macquart*, comprising *L'Assommoir*, *Nana*, *Germinal* (1885), *La Terre* (1887), *Un Rêve* (1888), *La Bête Humaine* (1889), *L'Argent*, *La Débâcle*, and *Dr. Pascal* (1893).

Zones, beds characterised by one or more distinctive fossils which, if not confined to their particular zone, are at least most abundant in it. Such subdivision by means of fossils is particularly useful in thick formations of uniform mineral character or appearance.

Zoological Station, a seaside laboratory for the investigation of the marine animals and plants of a district, fitted with apparatus for collecting, tanks in which organisms can be reared, and their development watched.

Zoology, the branch of Biology which deals with animals, as distinct from that other branch, *Botany*, which deals with plants. Some writers attempt to separate *Zoology* from *Natural History*, using the first term to include the study of the structure and activities of animals, and the second for the study of animals and groups of animals in their relations to one another and to their environment. Our definition includes the second as a branch of the first. The Middle Ages produced much literature about animals, chiefly legends and moralities, but no systematic treatise on the subject appeared till 1552, when Wotton, an Englishman, published at Paris his book *De Differentiis Animalium*, in which he made use of Aristotle's divisions, adding the Zoophytes, in which he includes the starfishes. Next came Gesner (1516-65), and Aldrovandi (1522-1605), and then Ray (1628-1705), the forerunner of Linnæus (1707-78), whose *Systema Naturæ* entitles him to be reckoned the founder of systematic zoology. The chief classifications since his day are those of Cuvier (1769-1832), H. Milne-Edwards (1800-84), Huxley (b. 1825), Haeckel (b. 1834), and Ray Lankester (b. 1847), the last two being on distinctly evolutionary lines. Zoology, as a whole, has been divided in various ways, the most recent, that of Professor Lankester, breaks it up into (1) *Morphography*, (2) *Bionomics*, (3) *Zoo-Dynamics*, *Zoo-Physies*, and *Zoo-Chemistry*, (4) *Plasmology*, and (5) *Philosophical Zoology*.

Zoophytes, or PLANT-LIKE ANIMALS, a term used in a popular way as the name for many plant-like animals.

Zoospore, motile spores, or reproductive masses of protoplasm, occurring among the Chlorospermous and Melanospermous algæ, and the Myxomycetes, Saprolegniæ, and a few other fungi.

Zoroaster, or ZARATHUSTRA, the founder or reformer of the old Persian religion. His period, birthplace, and personal history are unknown, but good authorities maintain that he cannot have lived later than 800 B.C. His main doctrine was the eternal warfare between Ormuzd and Ahriman (q.v.).

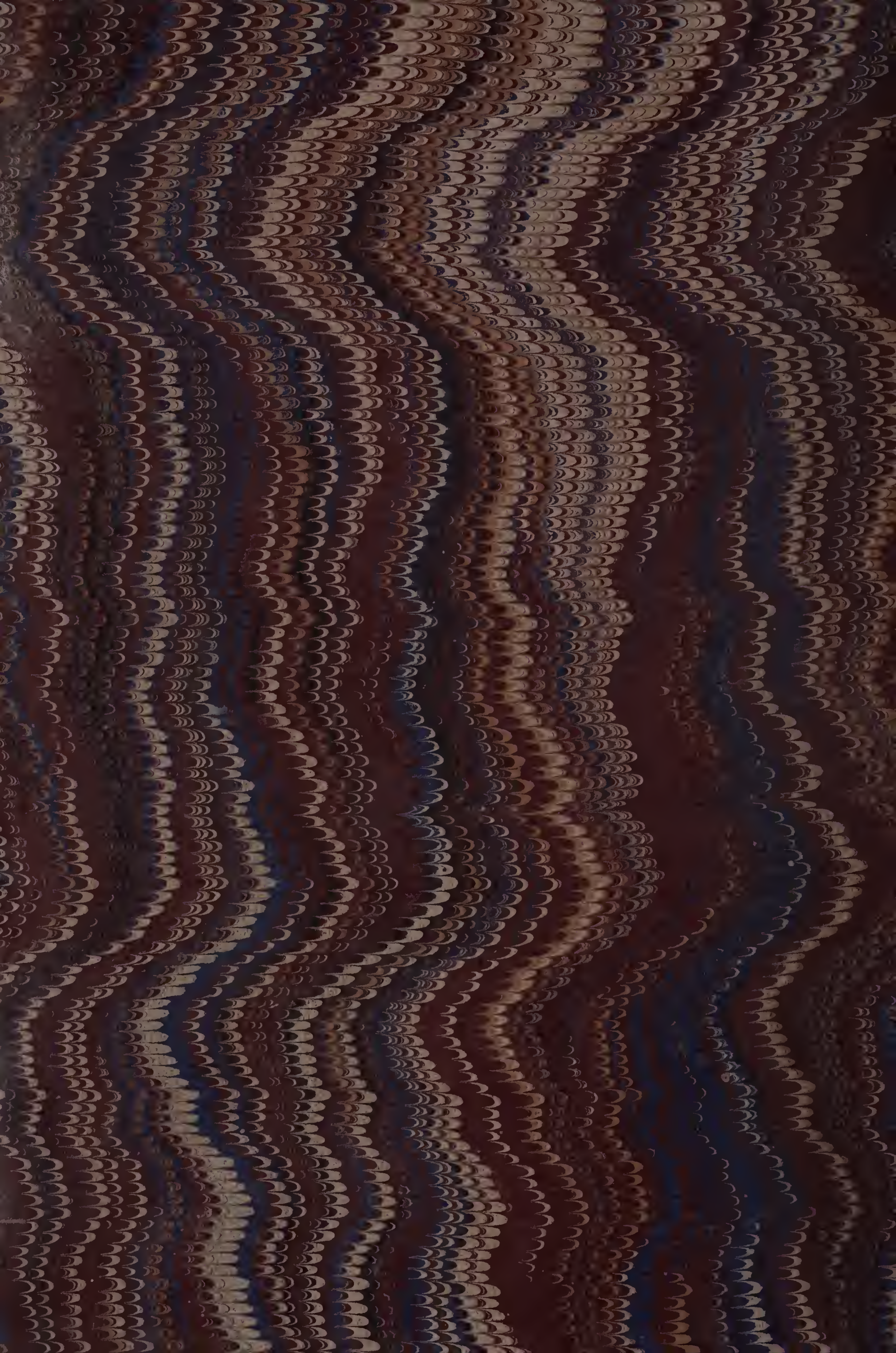
Zulu-Xosas (ZULU-KAFIRS), a main division of the Bantus (q.v.), whose original domain comprises the whole of the south-eastern seaboard of Africa from Delagoa Bay to Great Fish River, and extends from the coast inland to the Quathlamba and Drakenberg ranges. At present Gazaland is the only Zulu state which preserves even a semblance of political independence. The Ma-Zitu, Ma-Ravi, Ma-Ngone, and other Zulu hordes north of the Zambesi, have been brought under subjection or dispersed by the Germans in East Central Africa or by the English in Nyassaland. Ketchwayo, last of Chaka's dynasty, was overthrown by the English in 1879, and since his death (1884) Zululand itself has become a British protectorate, administered from Natal. Physically the Zulu-Xosas are a fine Negroid people, tall (averaging 5 feet 10 inches), symmetrical, and well-built, but betraying Negro blood, especially in the thick lips, dark colour, and woolly hair. Both mentally and morally they are superior to the full-blood Negro, displaying considerable intelligence in their social and political systems.

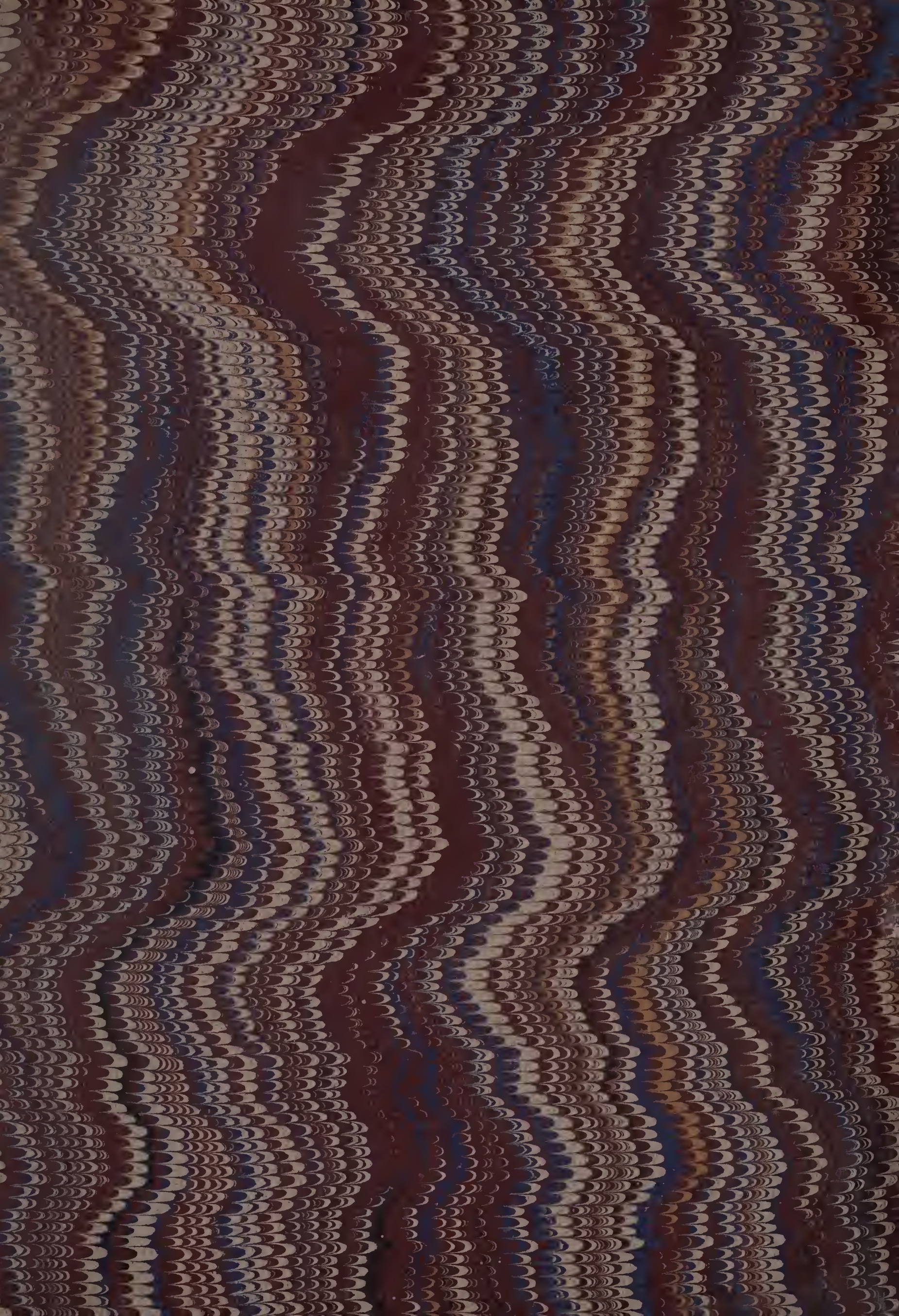
Zürich, a canton and its capital in the N. of Switzerland. The former has an area of 695 square miles, lying between Schaffhausen N., Schwyz S., Aargau W., and St. Gallen and Thurgau E. The surface is hilly rather than mountainous, the greatest elevations not much exceeding 4,000 feet. Zürich joined the Confederation in 1351, and seceded from Rome under Zwingli (q.v.) in 1519. The capital stands at the N. extremity of the lake, on the Limmat.

Zwingli, ULRICH (1484-1531), the Swiss reformer, was born at Wildhaus. After studying philosophy at Bern and Vienna, he repaired to Basel. In 1516 he retired to the solitary convent of Einsiedeln, whence he removed to Zürich at the opening of 1519 as preacher in the cathedral. He signalled his entry on his new office by his successful resistance to the sale of indulgences carried on by the travelling friar Samson. The Bishop of Constance endeavoured to awe him into silence, but a controversy at Zürich between Zwingli and his vicar-general, John Faber, resulted in the formal adhesion of the city to the principles of the Reformation (1523). In 1520 a war broke out between the Protestant and the Roman Catholic cantons. At Cappel, in 1531, the men of Zürich were routed, and Zwingli himself fell.

Zygospore, the product of conjugation of spores when there is no difference between the male and female element.

Zymotic Diseases, the acute specific diseases which are regarded as being caused by the growth and multiplication within the system of a ferment or leaven. The term "zymotic death rate" is applied to the death rate from the "seven principal zymotic diseases" (smallpox, measles, scarlet fever, diphtheria, whooping cough, fever, and diarrhœa). The zymotic death rate (mean annual death rate per thousand living) in England and Wales during the ten years (1871-80) was 3.26.





LIBRARY OF CONGRESS



0 033 261 315 7